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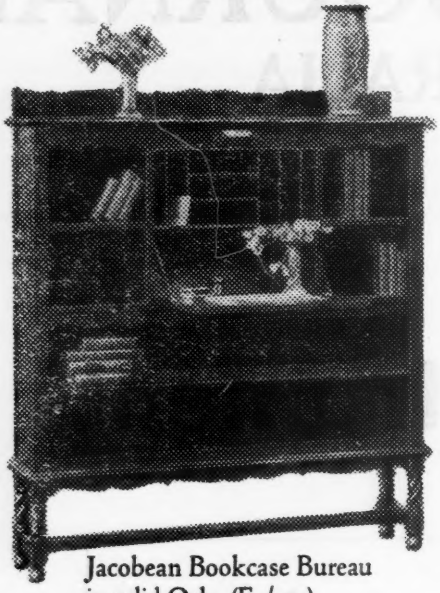

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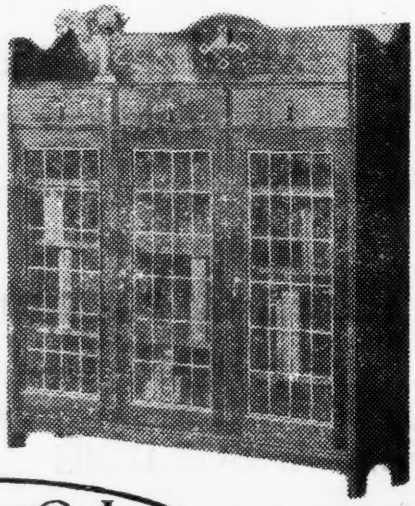

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A NEW OPERATIVE PROCEDURE IN THE TREATMENT OF SPASTIC PARALYSIS AND ITS EXPERIMENTAL BASIS.[1]

By N. D. ROYLE, M.B. (Sydney),
Honorary Orthopædic Surgeon to the Lewisham Hospital; Honorary Orthopædic Surgeon to the State Children's Relief Board.

MUSCULAR rigidity is the greatest factor in the production of the disabilities and deformities of spastic paralysis. It minimizes whatever control the patient may have over his muscular system; it involves him in a wearying process of striving to produce movement against a continual resistance and it is instrumental in producing much more functional disturbance than is warranted by the organic lesion. Current methods of treatment based upon the accepted physiology of spastic paralysis have to a certain extent and more particularly in young subjects alleviated the patient's condition, but have not removed the rigidity. From a clinical study of the effects of treatment it is evident that the hypertonicity and the rigidity must be due to some other factor than that which is usually attributed to the influence of medullated nerve fibres.

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on October 26, 1923.

Since it has been demonstrated by Boeke[1] and others that voluntary muscles are supplied by non-medullated fibres from the sympathetic system in addition to the medullated fibres from the anterior horn cells, considerable speculation and investigation have been directed to ascertaining the function of these sympathetic fibres. De Boer[2] claimed to produce a change in the tonic condition of muscles by sectioning their sympathetic nerves. Langelaan,[3] accepting De Boer's results, maintained that sympathetic nerves were concerned with the maintenance of plastic tone, whereas the ordinary medullated nerves were concerned with the production of contractile tone. Direct stimulation of the sympathetic has failed to effect a change in muscular tone, probably because adequate stimulus was not employed and if Langelaan's conception be correct, stimulation of these fibres would not effect an apparent change, since their function is only to maintain the existing length of a muscle. Many of de Boer's experiments were repeated by Kuno,[4] who formed the opinion that the results obtained were due to the effects of vaso-dilatation in the limbs deprived of their sympathetic supply. A much more important criticism of de Boer's results arises from the experiments of Dusser de Barrenne,[5][6] Van Rijnberk[7] and Cobb,[8] who found that section of the sympathetic nerve fails to influence the

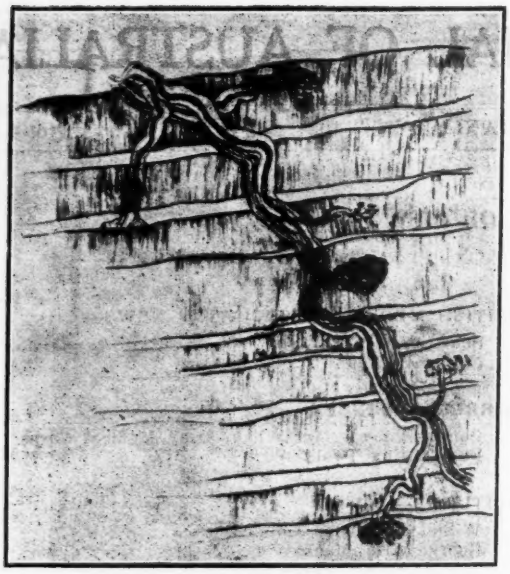

FIGURE I.
From a preparation by Kulchitsky and Dart, showing the distribution of non-medullated nerve fibres in a voluntary muscle.

development and maintenance of decerebrate rigidity. This condition appears in animals after section of the brain in the mesencephalon and is generally admitted to be due to a great increase in the tone of the muscles sustaining the animal against the effect of gravity. If the sympathetic nerves have anything to do with tone or with hypertonicity, the effect of their removal should be noticeable in decerebrate rigidity. These three investigators carried out their experiments on cats by removing the abdominal sympathetic trunk on one side either before or after decerebration. Dusser de Barenne found a diminution in tone in five instances out of nine; Van Rijnberk found no constant difference in nineteen experiments and Cobb could detect none in a series of six.

K. Uyeno[9] has also reported experiments in a decerebrate animal and failed to notice an appreciable difference in the rigidity of the fore limbs when the stellate ganglian had been stimulated electrically, paralysed with nicotine or completely removed.

Langelaan[10] has recently made an attempt to establish de Boer's results and while he has demonstrated definite changes in the hind limb of a frog after the removal of the sympathetic nerves, he has not shown that these changes are present in a decerebrate animal.

The whole evidence on the function of the sympathetic nerves has been reviewed by Adrian[11] who comes to the conclusion that all the recognized phenomena of tone can be produced in muscles which have been deprived of their sympathetic supply, and that the only reason for supposing that the sympathetic fibres may have any function at all, is the fact that they exist. This view is supported by F. M. R. Walshe[12] in a later contribution.

J. T. Wilson[13] in viewing the question from the morphological side comes to the conclusion that it is impossible to deny the presence of non-medullated fibres in voluntary muscles which are hypolemmal in their mode of distribution and that these relationships, if admitted, would seem to indicate a centrifugal conduction along these nerve fibre paths presumably of motor and possibly of tonic contractile character.

EXPERIMENTS TO DETERMINE THE FUNCTION OF THE SYMPATHETIC NERVES.

It is obvious, from what has been stated that nothing has been determined definitely concerning the function of the sympathetic fibres going to voluntary muscles. The fact that they exist and that each muscle fibre receives a sympathetic fibre is a good indication that they have an important function and it appeared not unlikely that this undetermined function could have a relationship to the phenomena of spastic paralysis. Experiments were therefore carried out with a view to determining:

(i.) The function of the sympathetic fibres supplying the voluntary muscles.

(ii.) Whether that function had any relationship to the abnormal muscular condition met in spastic paralysis. The following experiments were done.

Series I.

An attempt to reproduce spastic paralysis in animals as it occurs in the human subject was not successful and to get a condition in which hypertonicity appeared in the muscles of the lower limbs, the simple expedient of dividing the spinal cord of a rabbit was adopted. The left abdominal sympathetic trunk was removed immediately after section of the cord. Within a short time it was evident that there was a marked difference in the tonic conditions of the left and of the right lower limbs. The right limb tended to be maintained in the flexed attitude while the left one hung in an extended position. The amplitude of the knee jerks also showed an alteration; on the left side the response was very much less easily elicited and was

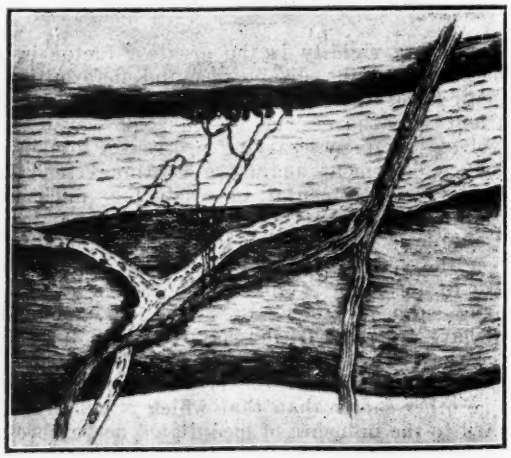

FIGURE II.
A similar preparation.

FIGURE III.
Showing the effect of the division of the left abdominal sympathetic trunk in a "spinal animal."

smaller than on the right side. Attempts to reproduce this experiment gave unsatisfactory and inconsistent results. In small animals such as the rabbit, although the sympathetic trunk is well defined, it is not altogether easy to be sure about its complete removal on one side and on one side only. A larger animal with a much more definite sympathetic trunk appeared to offer a better field for investigation and in all subsequent experiments the goat was used. There was actually another factor in producing the inconsistent results in this experiment and that was the disturbance set up by the surgical interference, for the whole observation was conducted on the one occasion.

Goat I. (1).—The spinal cord was divided on May 30, 1923, and two days later the left abdominal sympathetic trunk with its communications was removed. This was followed by an immediate change in posture in the left lower limb. Following upon division of the spinal cord both lower limbs went into flexion and adduction, but when the abdominal sympathetic trunk was removed the left lower limb assumed a more extended and a little more abducted position than the right (see Figure III.). This change became more evident at greater intervals from the time of removal of the sympathetic trunk. The knee and ankle jerks on the right side were exaggerated and the limb returned to the flexed attitude after elicitation of the knee jerk. In the left limb both knee and ankle jerks were obtained, but were of smaller amplitude and less easily elicited and when the left lower limb was placed in the flexed attitude, elicitation of the knee jerk was not followed by a return to the flexed attitude, but the limb remained extended. The resistance offered to passive movements in the right lower limb was considerable on account of the spasticity, but the left lower limb could be moved passively without any noticeable resistance. The whole reflex activity of the left lower limb was depressed. For instance, passive extension of the right lower limb was followed by two or three movements of flexion, while extension of the left lower limb resulted in only a slight degree of adduction of the thigh. When both lower limbs were extended simultaneously, the right was immediately drawn into the flexed attitude, but the left remained extended. After the sixteenth day a change appeared in the lower limbs and the reflex activity of the left side became greater than on the right. The animal died on the twenty-third day after section of the cord and at the time of death the right lower limb had no sign of any reflex activity. This alteration in the condition of the two lower limbs, which occurred about sixteen days after the first operation, was in all probability due to some degenerative change occurring in the spinal cord and the observations after this time do not give a reliable picture of the changes which occur as a result of the section of the sympathetic nerves.

Goat I. (2).—In this animal the sympathetic was removed on June 7, 1923, and transverse section of the cord was performed immediately afterwards. Similar changes to those described in connexion with the preceding experiment appeared, but the contrast in the condition of the two lower limbs was not as great. The animal was not well on the eighth day after operation and died a few days later.

Goat I. (3).—In this animal hemisection of the spinal cord was performed on the left side and the left abdominal sympathetic was removed on June 14, 1923. On the following day the right lower limb was in the flexed attitude. The left one was extended and abducted, though the tendon reflexes were similar on each side. At the end of seven days the animal had regained some voluntary control of the right side, but could not stand on its lower limbs. The left lower limb was particularly free from any signs of spasticity. At the end of fourteen days the animal could walk, but had difficulty in controlling the foot on the left side. This disability greatly improved and the animal had regained almost complete recovery of function in the left lower limb three months later (September 14, 1923). The animal could walk well and could run. The left lower limb was not spastic and when the animal was placed on its back, it fell into abduction and semi-flexion in contrast to the right lower limb which was held extended as in a normal animal.

Series II.

The effect of removing the left abdominal sympathetic trunk without any other procedure was next tried.

Goat II. (1).—The left abdominal sympathetic trunk was removed on June 4, 1923, and the animal was able to walk with a limp on the following day. Three days after the operation the animal still had a limp and the left limb appeared to be wasted. This appearance was probably due to the fact that the muscles were softer than on the normal side. On the seventh day the animal still walked with a limp and when placed on its back, it could not maintain the left lower limb in an extended position in contrast to the right side in which the animal could keep up a firm resistance to passive flexion. There was, in addition, a coarse irregular tremor in the left limb. On the eleventh day after the operation the animal could run vigorously. When the animal was placed

FIGURE IV.
Showing the effect of the division of the left abdominal sympathetic trunk in a decerebrate animal. (Taken from a cinematograph film.)

on its back, the lower limbs were extended and it was then found that the left limb could resist passive movements without evidence of tremor. When both limbs were flexed, the left one fell away from the flexed position. This occurred gradually in definite, jerky movements from position to position until complete extension was reached. There were no appreciable differences in the amplitude of the tendon reflexes on either side. Fifteen days after operation the animal still walked well and when placed on its back, extension of both limbs could be effected by the animal, but the extension on the left side was never complete nor well maintained. The same conditions were present eighteen days after the operation and it was noted that if the animal were frightened, both lower limbs went into extension, but the left one fell from the extended position as soon as the cause of fright was removed.

Similar observations were made on all the animals used in the next series of experiments. In one instance the observations extended over a period of eighty days and in another over a period of seventy-three days.

The Effect of Division of the Sympathetic Nerves Upon Decerebrate Rigidity.

The inconsistent results recorded by previous investigators called for some explanation and it appeared that the plan of experiment may in some cases have been at fault. In the following experiments the abdominal sympathetic trunk was removed at one operation and the animal was allowed to recover from the effects of surgical interference before the decerebration was carried out. The sensory disturbance set up by the wound in the lumbar region was thus avoided. The handling of the tissues in this region could profoundly affect reflex activity within a few days following the operation and the changes then seen could not necessarily be ascribed to the removal of the sympathetic trunk.

Goat III. (1).—The abdominal sympathetic trunk was removed on July 3, 1923. The animal made a complete recovery and fourteen days later decerebration was carried out. The anæsthetic was administered by the intra-tracheal method and the carotid arteries were ligated as a preliminary. The brain was then exposed and the cerebral cortex removed. An increase in tone in both lower limbs followed this procedure, but the right one afforded much more resistance to passive flexion than the left. This slight increase in tone was transient only. The basal nuclei and sufficient of the mesencephalon were then removed to produce decerebrate rigidity. When rigidity appeared, the condition was so evident in the right lower limb that flexion could only be produced with difficulty; on the left side, however, although extension occurred, the limb could be much more easily relaxed. In the intervals when rigidity of the lower limbs was less, striking differences were noticed. If both lower limbs were extended and abducted simultaneously and then released together, the left fell immediately into a completely flexed position, while the right one fell slowly and finally assumed a very much less flexed attitude. When the knee jerks were tested in these positions, a strong response was obtainable on the right side; on the left side the response was not greater than that obtained in a normal animal in repose. The animal lived for about twenty-one hours after decerebration had been performed.

Goat III. (2).—The left abdominal sympathetic trunk was removed on July 24, 1923. Decerebration was carried out at the end of fifteen days. The animal died shortly after the second operation, but not before decerebrate rigidity had developed with the differences on the two sides that have been already described in the account of the first experiment of this series.

Goat III. (3).—Similar experiments were performed on this animal and when decerebrate rigidity appeared, it was less evident in the right fore limb than in the left. In the right hind limb there was actually less rigidity than in previous experiments, but extension could be maintained, whereas in the left hind limb the characteristic position was that of flexion and abduction.

Goat III. (4).—In this animal the left abdominal sympathetic trunk was removed seventy-three days before decerebration. When decerebrate rigidity appeared the left lower limb extended for a few

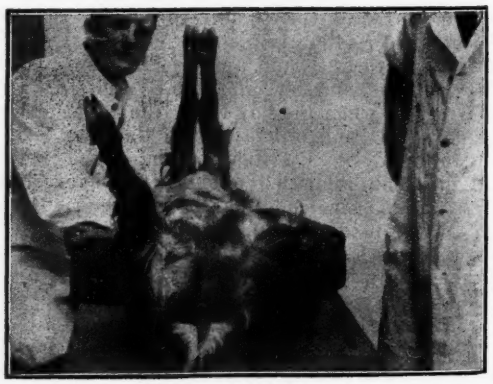

FIGURE V.
Another view of the same animal.

seconds only and then fell into flexion and remained flexed (see Figure IV.), while the other three limbs remained rigidly extended. This animal showed more clearly than any other used in these experiments that decerebrate rigidity as described by Sherrington did not affect the left lower limb. The tendency to go into extension did periodically affect the left lower limb, but the contrast in the two lower limbs was remarkable. The greatest force had to be employed to overcome the rigidity in the right limb, while in the left the absence of rigidity enabled flexion to be easily effected. Shortening and lengthening reactions as described by Sherrington were well shown in all limbs, except the left lower limb whose position as indicated by the accompanying illustration (Figure V.), was determined by mechanical factors.

Comments on these Results.

The removal of the left abdominal sympathetic trunk produced a similar effect in every experiment. Simple removal of the trunk did not interfere with the animal's ability to control the left lower limb, but the animal when placed on its back was not able to maintain the limb in an extended position and the amplitude of the tendon jerks was diminished. Similar observations to those described in Series II. were made on five other animals, in some instances over long periods. In every instance the observations indicated that there was certainly a definite change in the left lower limb when compared with the normal limb of the opposite side and that change may be described as a depression in reflex activity and a disturbance of the mechanism for maintaining the posture of the limb.

The hypertonicity and the flexion following transverse section of the cord were profoundly altered in the left lower limb after section of the left abdominal sympathetic trunk. In contrast to the right lower limb the left limb fell into extension and abduction under the influence of mechanical factors, while the knee and ankle jerks were less active. When decerebrate rigidity was produced under the conditions which have been described in Series III., the most striking differences appeared. The division of the left abdominal sympathetic trunk prevented the onset of decerebrate rigidity in the left lower limb, but the limb participated in the periodical extending movements only to fall into flexion immediately, while all other limbs remained in extension. During the intervals when rigidity was less evident the right and the left lower limbs still exhibited a striking contrast. The right limb usually maintained a semi-flexed attitude through the period of decerebration and the knee jerk was readily obtained and exaggerated in character. The left lower limb, on the other hand, fell into a more flexed attitude and while the knee jerk was obtainable, it was decidedly less in amplitude. If, however, the left lower limb were put into a similar position to that assumed by the right lower limb, the knee jerk exhibited about the same amplitude. These conditions were best developed in the fourth animal and it appears that the length of time between the removal of the sympathetic trunk and decerebration is the factor which alters the character of the observations. The most striking changes were seen in the animal which was decerebrated seventy-three days after the removal of the sympathetice nerves.

Experimental Operation in the Human Subject.

The differences in all these animals were so great and so consistent that it was considered justifiable to test the therapeutic value of the observation and endeavour to find some relief for the rigidity accompanying spastic paralysis in the human subject. A willing patient, A.C., offered himself and submitted to operation on September 1, 1923.

This patient had had a gun shot wound of the cerebral cortex. The bullet had entered his skull just above the left ear and had caused an extensive laceration of the cerebral hemisphere in the region of the central sulcus of the left side. The wound had extended across the middle line on to the opposite cerebral hemisphere. The patient at time of the operation was thirty years of age and the injury had been received seven years previously. He had been unable to speak for three months and to walk at all for over two years after the receipt of the injury. Spastic hemiplegia affected both limbs on the right side; the left lower limb was affected also, but only in the leg and foot. The knee jerk of the left lower limb was normal; the ankle jerk was exaggerated and there was an ankle clonus. The whole foot was rigid and the patient's control was very defective. The only deformity present on the left side was a slight degree of *talipes equinus*. On the right side there was an exaggerated knee jerk, a patella clonus, an ankle clonus and an increase in the ankle jerk. The patient could walk, but had the greatest difficulty in controlling the right lower limb which he moved as one rigid piece. When he placed weight on the limb there appeared a coarse uncontrollable tremor. He could not stand on the right lower limb, though he could stand comfortably on the left. It was only possible for him to move forwards; lateral or backward walking could not be carried out. There was present also a slight degree of *talipes equinus* on the right side. This patient was subject to occasional tonic fits of only short duration, which could be easily controlled by the administration of sedatives. The control of his genito-urinary system was normal, but the patient suffered from chronic constipation.

The Operation.

An incision was made to the lateral side of the right *sacro-spinalis* muscle and extended from the last rib to the crest of the ilium and forwards for about seven and a half centimetres (three inches). The lumbo-dorsal fascia was divided at the lateral side of the sacro-spinalis and the oblique muscles were freed from the crest of the ilium for about five centimetres (two inches). The left hand was then passed behind the peritoneum and in front of the fascia covering the *quadratus lumborum* and the psoas muscles until the vertebral column was reached. The abdominal wall and the abdominal contents were then retracted forwards and the right sympathetic trunk was exposed. There is some difficulty in doing this owing to the depth of the wound. In a normal adult the distance from the line of incision to the abdominal sympathetic trunk is between fifteen and seventeen and a half centimetres (six and seven inches). Difficulty was experienced in getting dissectors of sufficient length to carry out the necessary blunt dissection in the region of the sympathetic trunk. The trunk lies conveniently in an anterior position on the lumbar vessels (see Figure VI.), but is overlapped on the right side by the inferior *vena cava*. The sympathetic trunk was not difficult to

recognize in the living subject, but had actually a very different appearance to that seen in the cadaver. One surprising feature was the number and complexity of the branches. The trunk was exposed from the second lumbar nerve to where it disappears under the iliac vein. The white ramus from the second lumbar nerve was first divided and the grey rami going to the second, third and fourth lumbar nerves were avulsed. The fourth lumbar ganglion was then defined and the sympathetic trunk was divided immediately below. By this means the grey *rami communicantes* to the fifth lumbar nerve and to the sacral nerves were divided.

The Changes Following the Operation.

Following the operation the patient had very little discomfort and no evident alteration to functions of the bladder and of the rectum. On the first day the patient had 0.01 gramme (one sixth of a grain) of morphine only and described his own condition as comfortable. Six hours after the operation the patient was examined. The right lower limb felt warmer than the left, but there was actually no difference in temperature to be detected with an ordinary clinical thermometer. The right lower limb was a brighter colour than the left and there was evidence of capillary dilatation. There was no œdema, but on measuring the circumference of the calf the right was about one centimetre larger than the left. The muscles of the right lower limb were also undergoing coarse fasciculation which disappeared when the muscles were completely relaxed. This was particularly noticeable in the calf muscles. On comparing the right leg and foot with the left, there was a remarkable contrast in the spastic condition. If the left leg were passively pushed into dorsi-flexion, there was a tendency for this position to be maintained and only slowly was the attitude relaxed. On the right side, however, passive dorsi-flexion of the foot was followed by immediate and complete relaxation. The knee jerk was still exaggerated and an ankle clonus could still be obtained. The patient felt that in the right lower limb a great change had occurred which he described as a feeling of freedom. On the day following the operation the control of the right lower limb had improved. Fasciculation was still evident in the calf muscles. There was still no œdema, but the limb felt warmer and was a deeper shade of pink than the opposite limb. The patient bent and straightened his knee easily. Passive movements of the foot and ankle were easily done in contrast to the rigidity which still obtained in the left leg and foot. There was no disturbance in the control of the bladder. Two days after the operation the patient was still comfortable; the reflexes on the right side were still exaggerated, but the patient discovered that he could move the right lower limb as easily as he could the left. Fasciculation was still evident in the calf muscles and for the first time was noticed in the extensors of the toes. The limb still had a more flushed appearance than the opposite one. On the fourth day following operation the reflexes were exaggerated on the right side, though there was no return to rigidity. Fasciculation in the calf muscles was apparent. On the fifth day the fasciculation appeared to be less evident. The reflexes were still increased, but there was less tendency to clonus in the right lower limb. On the seventh day fasciculation had almost disappeared. The other conditions remained practically the same. During the whole period the patient had very little discomfort and was able to stand on the ninth day. It was then found that the tremor which previously had appeared when he tried to use the limb, was not present. He could walk one or two steps when supported and expressed the opinion that he had regained control of his limb. On this day fasciculation could hardly be detected and the ankle clonus was less easily elicited. On the tenth day after operation the patient could stand easily and walk a few steps. On the twelfth day following operation the patient's attempt to walk was characterized by movements which were exaggerated in amplitude. This tendency was due to his previous habits and on being corrected a fair attempt at walking was carried out. In addition he was able to walk backwards for the first time since his injury. Fasciculation was no longer detected. The colour of the right lower limb

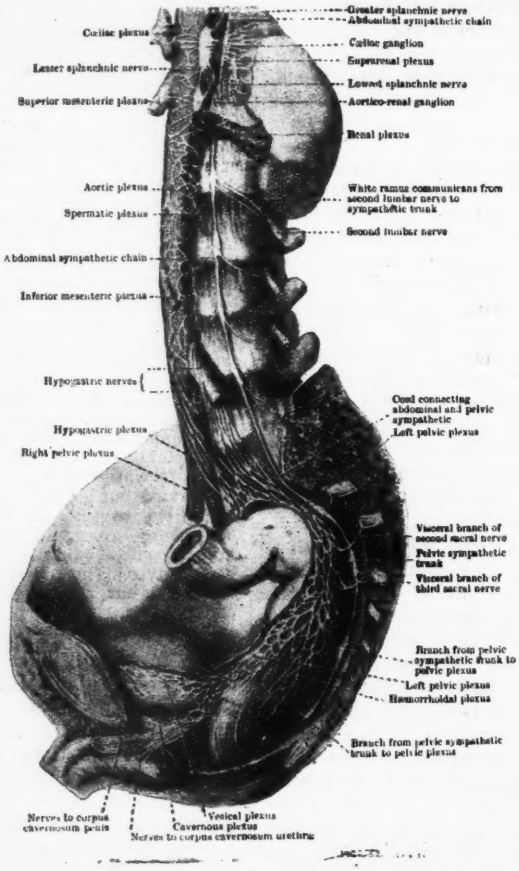

FIGURE VI.
Showing the abdominal sympathetic trunk and its connexions (Cunningham).

FIGURE VII.
One picture from a cinematograph film of the patient balancing on his affected limb.

was still brighter than that of the left and on removing pressure the colour took about twice as long to return on the left as on the right. The patient was allowed to sit up on the fourteenth day and carry out short periods of walking exercises. When examined on the seventeenth day the patient walked with great improvement in his movements. He was able to walk backwards almost as well as forward and could balance his weight on the right lower limb when using a stick in the opposite hand. There was some degree of fasciculation seen in the calf muscles after walking. The vaso-motor disturbance had practically disappeared and there was no difference in the rate of return of colour after pressure in either limb. On the nineteenth day after operation the patient had so far improved as to be able to walk up and down steps using each limb alternately to negotiate each step.

On the twenty-fourth day after operation further improvement had occurred. There was practically no clonus in the right ankle, though this condition was still evident on the left side. The patient could easily ascend and descend a flight of steps, but during the descent it was noticed that when the whole weight was taken on the right lower limb a slight tremor appeared. This did not interfere with the actual control of the movements. The accompanying illustrations (see Figures VII. and VIII.) show the patient taking the weight on his right lower limb in walking down steps and balancing on the right lower limb while performing movements with the left.

Thirty days after operation the knee and ankle clonus had disappeared on the right side, but ankle clonus was still present on the left. There was actually very little difference between the amplitude of the knee jerks on either side. The patient had now acquired the ability to relax the right lower limb during the phase of movements when weight was taken on the left lower limb and to carry it forward in a manner closely approximating the normal gait. Walking up and down stairs was also performed quite easily. The right lower limb was still slightly larger than the left, but the difference in circumference did not amount to more than 0.5 centimetre. There was no difference in colour and the capillary circulation could be obliterated with equal ease on both sides. On the forty-second day following operation improvement in control of the right lower limb was still continuing. Although the patient walked with comparative ease, he had not yet established control over the groups of muscles in his right lower limb. He could extend his knee joint, but had very little idea of performing flexion of the knee or any of the movements at the ankle joint or in the foot. The control of his hip muscles was fairly well establishhed and the patient could carry out movements in all directions, but within certain limits. It was then noticed that the range of the various movements at the hip joint was still limited by a certain amount of structural changes in the muscles. There was also still a definite amount of *equinus* deformity present at the ankle joint which prevented the patient from clearing the ground in a normal fashion. This deformity was due to structural changes, as there was actually present a contracture in the plantar flexing muscles.

Fifty-four days after operation the patient had improved to such an extent that he relaxed the formerly spastic limb almost in a normal manner when walking. The knee jerks were practically equal on both sides, but with regard to the ankle clonus it was still present in a definite form on the left side, but was not present on the right side nor was there any sign of abnormal tone in the muscles of the right lower limb.

Second Patient.

Patient H.C. had suffered from spastic hemiplegia on the right side for fourteen years. The upper limb was useless as there was only the slightest degree of voluntary control in the *flexor profundus* of the fingers. The hand was rigidly dorsi-flexed at the wrist, flexed at the metacarpo-phalangeal joints, extended at the proximal inter-phalangeal joints and flexed at the distal inter-phalangeal joints. The thumb was dorsi-flexed at the metacarpo-phalangeal joint and flexed at the inter-phalangeal joint. The forearm was fixed in pronation and could not be passively supinated. The rigidity was so severe that it was impossible to flex or extend a finger passively and the extensors

FIGURE VIII.
A picture taken from a cinematograph film of patient walking a flight of stairs.

of the wrist resisted forceful passive flexion. The wrist jerk was exaggerated and followed by a clonus.

The Operation.

The operation was performed on October 17, 1923. An incision along the posterior border of the right sterno-mastoid muscle gave access to the brachial plexus. The nerve roots were exposed and traced to their origin behind the *scalenus anterior* muscle. The *scalenus anterior* was lifted forwards and the *rami communicantes* to the fifth, sixth and seventh cervical nerves were defined. The *rami* to the eighth nerve and the first thoracic nerve were obtained by carrying the dissection downwards behind the subclavian artery. The grey *rami* to the whole plexus were then avulsed and the wound closed. This approach avoids all important structures in the neck and allows the essential operation to be carried out, that is division of the efferent sympathetic fibres to the musculature of the upper limb.

The Changes Following the Operation.

Immediately after the operation it was evident that the former rigidity had been very much diminished. It was possible to flex the wrist passively without any resistance from the extensor muscles. The fingers could be flexed and extended at the inter-phalangeal joints, but could not be extended at the metacarpo-phalangeal joints on account of structural changes which had occurred there. The forearm could be supinated without resistance through an angle of about 45°. The following day the patient discovered he could voluntarily dorsiflex the wrist joint and three days later he could supinate his forearm. The reflex activity was very much diminished though the wrist jerk was still easily elicited. Vaso-motor disturbance similar in character to those described in the patient A.C. were observed.

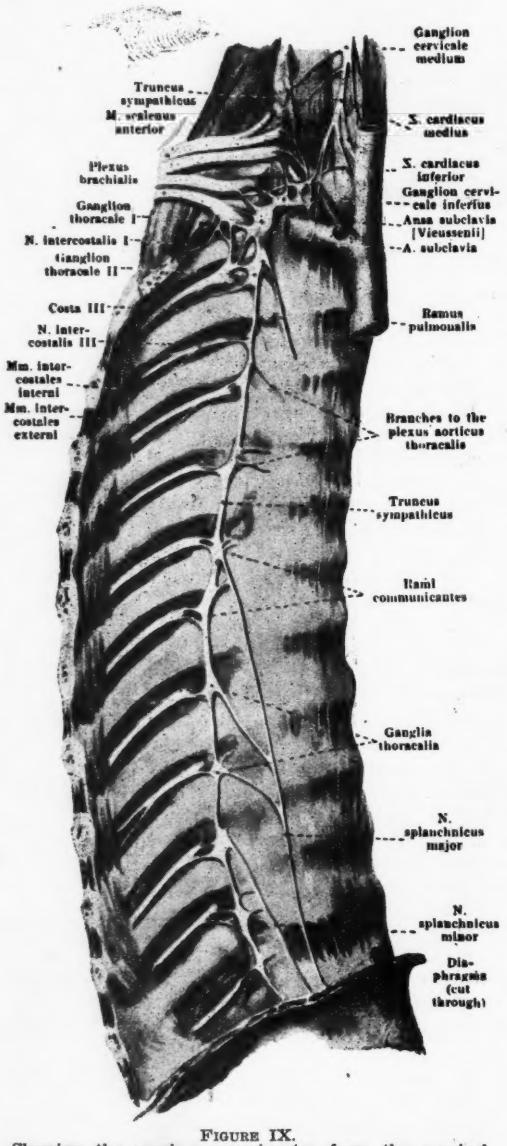

FIGURE IX.
Showing the *rami communicantes* from the cervical sympathetic trunk to the brachial plexus (Spaltholz). The muscle labelled *Scalenus anterior* is the *Scalenus medius*.

Since the operation there has been a remarkable gain in voluntary control in this perfectly useless hand and there appears no reason why an improvement should not continue when the structural deformities become lessened. This patient underwent operation only fourteen days before this account was written.

Changes in the Human Subject Following Division of the Sympathetic Nerve.

A remarkable change has occurred in the function of the lower bowel in the patient A.C., who underwent the operation described above. Before the operation it was necessary for the patient to take large doses of purgatives every day. Since the operation constipation has entirely disappeared and there has been no necessity for the administration of any purgative at all. According to the patient's description the movements of the bowels are normal and a motion occurs at least once daily.

Diminution of Rigidity.

The most obvious change that has occurred in these patients, is the diminution of rigidity. In each case there is also a diminution of the amplitude of reflex movements. The diminution of rigidity has restored the patient's balance on the affected limb in one case and has enabled the patients to relax the affected muscles in both cases at will. The loss of balance in spastic paralysis appears to be due to the fact that the patient cannot quickly change position. With the diminution of rigidity the change of position is easily effected and alterations in the centre of gravity can be compensated by changes in the state of contraction of the muscles of the lower limb. The tremor which was such a disturbing feature in the right lower limb of the patient A.C. before operation, has entirely disappeared. Before operation this was so evident that the patient could not maintain his weight on this limb. The probable explanation of the disappearance

of the tremor again depends upon the diminution of rigidity.

Alteration in Muscular Control.

There was in both these patients an immediate and progressive gain in control. In the patient A.C., the only movement that could be performed as an isolated action, was that of extension of the knee. Since the operation flexion and extension of the hip joint, adduction and abduction at the hip, dorsi-flexion and plantar flexion of the ankle joint have been definitely acquired. The mental effort required in performing movements is very much less and the patient's concern now is to try and co-ordinate the various movements of progression and not simply to lurch forward on a rigid limb.

Vaso-Motor Disturbances.

The vaso-motor disturbances in both of these limbs were considerable only during the first week following the operation. The changes were characterized by an alteration in colour of the limbs, by inability to obliterate the capillary bed and apparently by a slight increase in the size of the limb. Unfortunately the patients' limbs were not measured before operation, but following operation in the case of the patient A.C., there was not at any time more than one centimetre difference in the circumference of the calf muscles. At the end of the fortnight these changes had practically disappeared. The patients have had no discomfort from vaso-motor changes and have been quite unconscious that any such changes have occurred. Hartman, Blatz and Kilborn[14] have shown experimentally that the increase in volume and temperature in a limb deprived of its whole nerve supply is only transient in nature.

The Possibility of Wasting.

An important question that had to be decided before the sympathetic nerves were cut, was whether there would be any wasting following operation. In the case of experiment animals the difference in weight of the *tibialis anterior* and the *extensor communis digitorum* for a period exceeding twenty-one days did not exceed the normal variation which could occur in limbs of opposite sides in the same animal. In one case there was 4.3% difference in weight and in another case 0.32% difference in weight. In the animal *III.* (4) the difference in weight after seventy-three days did not exceed 5% and the normal limb was the lighter. In the human subject there does not appear to be any wasting of the muscles and the actual size of the limb in which the sympathetic nerves have been cut, is slightly greater than the opposite limb.

The Application of Sympathetic Ramisectomy.

In the two patients who have submitted to operation, the spastic paralysis was present in the worst conceivable form. In the patient A.C. there was practically no control of the lower limb in respect to individual movements of joints. The whole limb was rigid in extension and the patient walked upon it as upon a rigid support. In the patient H.C., spastic paralysis had been present in the right upper limb for over fourteen years and before operation the wrist and hand were practically rigid. There was just the slightest element of control in the flexors of the fingers. This patient had no sign of pronating and supinating movements. In both of these instances there has been a remarkable diminution of rigidity with such an increase of the ability to control movements that the procedure should be effective in practically all cases of spastic paraplegia and hemiplegia. The best results will be obtained in those patients whose movements are present, but are rendered defective on account of rigidity, though the diminution of rigidity will probably enable movements to be performed that were quite impossible beforehand. In spastic paraplegia of infancy the difficulties of balance would be very much lessened after section of the sympathetic nerves. In addition the diminution of rigidity would enable the patient to make effective whatever cerebral control happened to be present and should assist materially the process of education. In those instances in which hemiplegia comes on as the result of trauma or disease and the paralysis is not progressive in nature, similar results should be obtained, in all probability much more readily as in these cases the process will be one of re-education only.

The Permanence of the Results.

Sympathetic ramisectomy is a procedure which deals with efferent nerve fibres and prevents discharge from the central nervous system into the affected muscles. Forster's operation dealt with afferent fibres and it is possible the results were due to interference with the afferent sympathetic return. The whole of the afferent return could not be destroyed and the spasticity tended to relapse. Stoeffel's operation attacked the nerves on the peripheral side, but simply with the idea of reducing a definite amount of nerve supply to the stronger and contracted groups. Results were certainly obtained by this method and it is not unlikely that here also the plastic tonus of certain muscles was affected because sympathetic fibres were cut in the peripheral neurectomies of the medullated nerves. Obviously in Stoeffel's operation the whole of the nerve supply to a muscle would have to be divided before the rigidity could be totally diminished. Nutt[15] has proposed a complete division of the sciatic nerve and while this may have some effect on the muscles of the leg and foot, it cannot be applied to spasticity in the region of the hip. The permanence of sympathetic ramisectomy seems to be assured in that the channels by which the excessive plastic tonus reaches the muscles, are obliterated.

Modification of the Operative Procedure.

The operation which is described for dealing with spastic paralysis of the lower limb, could be modified in this respect. There is actually no need to take out the white ramus from the second lumbar nerve if it is simply desired to attack rigidity in the lower limb. In this instance the division of the white ramus had an effect which was not anticipated, but which indicates a possible line of treatment for chronic inactivity of the lower bowel.

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In conclusion I wish to express my indebtedness to Professor John I. Hunter for his assistance in arranging the plan of experiments and for his constant advice and help in interpreting the results

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In performing the first operation I had the valuable moral and surgical support of Dr. T. W. Lipscomb.

References.

(1) J. Boeke: "*Die doppelt (motorische und sympathische) efferente Innervation der quergestreiften Muskelfasern*," *Anatomischer Anzeiger*, 1913, *Band* XLIV., *Seite* 419.

(2) S. de Boer: "*Die Bedeutung der tonischen Innervation für die Funktion der quergestreiften Muskeln*," *Zeitschrift für Biologie*, 1915, *Band* LXV., *Seite* 239.

(3) J. W. Langelaan: "On Muscle Tonus," *Brain*, 1915, Volume XXXVIII., page 235.

(4) Yas Kuno: "On the Alleged Influence of Adrenalin and of the Sympathetic Nervous System on the Tonus of Skeletal Muscle," *The Journal of Physiology*, 1914, Volume XLIX., page 147.

(5) Dusser de Barenne: "*Über die Enthirnungsstarre* (Decerebrate Rigidity Sherrington's) *in ihrer Beziehung zur efferenten Innervation der quergestreiften Muskeln*," *Folia Neuro-biologica*, 1913, *Band* VII., *Seite* 651.

(6) Dusser de Barenne: "*Über die Innervation und den Tonus der quergestreiften Muskeln*," *Archiv für die gesammte Physiologie*, 1916, *Band* CLXVI., *Seite* 145.

(7) G. van Rijnberk: "*Recherches sur le Tonus Musculaire et son Innervation*," *Archives néerlandaise de Physiologie*, 1916, *Volume* I., *page* 702.

(8) S. Cobb: "A Note on the Supposed Relation of the Sympathetic Nerves to Decerebrate Rigidity, Muscle Tonus and Tendon Reflex," *American Journal of Physiology*, 1918, Volume XLVI., page 478.

(9) K. Uyeno: "On the Supposed Relation of the Sympathetic to Muscle Tone," *The Journal of Physiology*, 1922, Volume LVI., page 43.

(10) J. W. Langelaan: "On Muscle Tone," *Brain*, 1922, Volume XLV., page 434.

(11) E. D. Adrian: "Muscle Tone and the Sympathetic System," *Medical Science Abstracts*, 1920, Volume II., page 454.

(12) F. M. R. Walshe: *Medical Science Abstracts*, 1921, Volume V., page 58.

(13) J. T. Wilson: "The Double Innervation of Striated Muscle," *Brain*, 1921, Volume XLIV., page 234.

(14) F. A. Hartman, W. E. Blatz and L. G. Kilborn: "Studies in the Regeneration of Denervated Mammalian Muscle: Volume and Temperature Changes," *The Journal of Physiology*, 1919-1920, Volume LIII., page 92.

(15) J. J. Nutt: "Further Observations on Intra-Perineural Neurotomy in Spastic Conditions," *Journal of Bone and Joint Surgery*, July, 1922, page 453.

THE POSTURAL INFLUENCE OF THE SYMPATHETIC INNERVATION OF VOLUNTARY MUSCLE.[1]

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THE discovery of Perroncito(1) and Boeke(2) of accessory nerve endings in voluntary muscles opened up a field for physiological research. De Boer(3)(4) (quoted by Bayliss(5)) came to the conclusion that muscle tonus was maintained by these sympathetic nerve fibres and Langelaan(6)(7) has supported this view. But as Adrian(8) in a recent review has pointed out "there is an important body of evidence which is directly opposed to the view that the sympathetic has anything to do with the development of the maintenance of tone." The fundamental objection levelled at their conception of de Boer is that the experimental attempts to reduce tone in decerebrate rigidity, has lead to very uncertain results.(9)(10)(11)(12) For instance Cobb (*loco citato*, page 482) concludes that section of the abdominal sympathetic chain in cats has no effect on decerebrate rigidity either by preventing its development or by inhibition. Later Uyeno(13) came to a similar conclusion for the upper extremity: "That neither stimulation of the stellate ganglion nor its paralysis by nicotine have any appreciable effect on decerebrate rigidity." Adrian(8) concludes that: "There is no doubt that the skeletal muscles are connected to the sympathetic system, but the sympathetic fibres are not concerned with tone." Also Walshe(14) pointed out that: "De Boer's interpretation of the function of the sympathetic innervation of voluntary muscle has been confirmed by no subsequent worker and has been impugned by all who have repeated his experiments."

This view was supported on the whole at the Eleventh International Physiological Congress, held at Edinburgh in July, 1923, where "several workers (including Professors Botazzi and Hess) reported that they had been unable to find that interference with the sympathetic system had any effect on either the tone or the nutrition of skeletal muscle."(15)

The work of Royle, published in this issue, shows consistent diminution in tone on the side on which the sympathetic innervation of the lower limb was removed in animals otherwise unoperated upon, in animals with complete transverse lesions of the spinal cord and in animals exhibiting decerebrate rigidity. Royle adopted with advantage the procedure of inducing decerebrate rigidity at an interval of some days after removal of the ganglionated sympathetic chain in the lumbar region and it is significant that the best contrast between the two limbs after section of the mid-brain was to be seen in the case of an animal in which the sympathetic chain of one side had been removed seventy-three days previously. The removal of the grey *rami communicantes* to the upper and lower limb plexuses respectively in two human patients showing a considerable condition of spastic paralysis due to an upper neurone lesion in each case had the same effect as in the animals. These results prove conclusively the relationship of the sympathetic innervation of voluntary muscles to muscle tone.

An analysis of the effect of such an operation in the decerebrate animal shows that the plastic tonus of Sherrington(16) is absent. Thus temporarily and for a very short time the partially denervated limb like the intact limb would assume an extended position, but this position could not be maintained and the limb would fall into an abducted and flexed

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on October 26, 1923.

position under the influence of gravity. When this relaxation does occur the muscles do not tend to remain fixed in any position in which the limb may be placed, *id est* plastic tonus is absent on this side. On the intact side on the other hand the plastic tonic state of the limb musculature tends to fix the limbs in any position which they may take up after spontaneous relaxation or when the observer overcomes the extension by mechanical means. In the case of complete transverse lesions of the spinal cord, though even in lower animals the contrast is necessarily not so great, because plastic tonus is less constantly shown under conditions following this injury than in decerebrate rigidity, a similar result follows the removal of the sympathetic innervation of the limb musculature in this condition. In otherwise normal animals voluntary resistance against pressure directed towards altering the position of the limb is less easily maintained in the case of the limb which is lacking the sympathetic nerve supply to voluntary muscles, than on the intact side. The main disability is to maintain a position once assumed and this disability is present whether the position is attained by voluntary activity, mechanical deformation or as a result of reflex activity. Following the removal of the sympathetic nerves of one limb it has already been noted that in the condition of decerebrate rigidity the position of the extension characteristic of this condition may be assumed and then almost immediately lost. It is evident that this temporary extension is brought about by the somatic innervation of the muscles which is still intact. The action of gravity or mechanical force easily overcomes this posture which is not maintained as on the normal side. Sherrington[16] has shown that muscle tone is the result of a purposive reflex action whose source is the muscle itself, the physiological purpose of which is to endow a posture on the limb concerned.

The term contractile tonus may be employed in contrast to plastic tonus to indicate the state of tonic contraction which has a selective action on different groups of muscles and which is dependent on the intactness of the somatic proprioceptive reflex mechanism. The term has recently been used by Langelaan.[7] He repeated de Boer's experiments on frogs and concluded that the maintenance of plastic tonus is a function of the sympathetic innervation of voluntary muscles. In this condition the muscle is in equilibrium. Langelaan's definition of the other element of tone of normal muscle is that when the muscle is in a state of contractile tonus, it is in a condition of slight contraction. It must also be kept in mind as already indicated from the work of Sherrington that contractile tonus is selective in its effect so determining the posture of the part concerned.

In conditions of spasticity of the limbs both elements of tone which are possessed by normal muscle, are increased in degree due to release of control from higher nervous reflex arcs. In other words, in spastic limbs there are two components of tone abnormally increased. The increased contractile tonus leads to hyperactive tendon reflexes and confers a posture on the part concerned. The increased plastic tone causes rigidity of the limb by maintaining the limb rigidly in the position assumed. It is this rigidity which impedes any voluntary movement of which the patient may still be capable. It can be removed, so that the contractile tonus alone remains by removing the sympathetic innervation of voluntary muscles. This is done by severing the gray *rami communicantes*.

The experiments so far conducted throw light upon the peripheral mechanism concerned in the production of plastic and contractile tonus. Though the investigations are far from complete, clinical facts together with experimental results so far recorded point to the levels of activity of the central mechanism involved in the production of the two aspects of tone.

In decerebrate rigidity the *corpus striatum* and red nucleus are removed as well as the cerebral cortex, for the section of the brain passes between the superior and inferior colliculi. It is possible that the effects of decerebrate rigidity may in part be due to the removal of the influence of the *corpus striatum* from the prespinal centres. It is significant that muscular rigidity is the fundamental symptom of all *corpus striatum* lesions except Huntington's chorea. This rigidity is in all probability an expression of the removal of the influence of a controlling centre over prespinal centres subserving reflex plastic tone. That in effect the release phenomenon of Hughlings Jackson is here exhibited. It is interesting that Kappers[17] has pointed out that the *corpus striatum* developes near the frontal end of the *sulcus limitans* which, according to Herrick and others, ends in the præoptic recess. He suggests that on these grounds the body may be of sympathetic origin. Such facts suggest that removal of the influence of the sympathetic innervation may be practised in special cases where disability has resulted from *corpus striatum* lesion following, for example, *encephalitis lethargica* in young adults.

The fact that the special function of the sympathetic innervation of voluntary muscle is maintenance of posture is of great general significance. It has long been known[18] that the origin of the vaso-constrictor nerves was confined to the white rami of the sympathetic system. Recent work of Krogh[19] proves that this influence is also exerted over primitive muscle cells (cells of Rouget) which partially enclose the endothelial wall of capillaries. Krogh follows Sherrington in using the term "posture" for the state of tonus possessed by the involuntary musculature of blood vessels which is subject "to the organism to hormonal, nervous and other influences."

Sherrington[20] has also shown that the conception of posture as illustrated by the plastic tonus of voluntary muscle may also be transferred to the smooth muscle of hollow viscera.

The normal posture of a hollow viscus at any particular time is that degree of dilatation necessary to include its contents. In the case of the intestine the best example of the mechanism on which this activity depends, can be seen in the sigmoid flexure of the rectum, called the "distal portion of the colon."[21] The descending colon is

never distended, but appears to be an area of irritability rapidly transferring its contents to the sigmoid. This is in contrast to the "distal colon" which becomes distended by its contents. The nerve supply of the colon is received like the small intestine from both the sympathetic and parasympathetic nervous systems. The former consists of colonic inferior mesenteric nerves, stimulation of which causes relaxation of the bowel and contracting of the internal sphincter of the anus. The pelvic nerves of the parasympathetic nervous system when stimulated cause evacuation by contraction of the muscle wall and relaxation of the sphincter. It will be observed that normally evacuation is the result of an intermittent activity superposed upon a continuously acting sympathetic influence which regulates and maintains the "posture of the bowel" until the parasympathetic reflex leads to defæcation.

An excellent illustration of the continuously acting regulating effect of the sympathetic innervation of the distal colon can be obtained by transecting the spinal cord above the last thoracic level. The experiments were performed on rabbits. Immediately following the transection of the cord there is retention of fæces. It is possible to open the peritoneal cavity of a "spinal animal" without the administration of an anæsthetic, although light ether anæsthesia was sometimes employed. The distal colon will be found to be inactive. That this is not due to temporary reflex inhibition due to the incision, is shown by the over-distension exhibited by this part of the bowel due to retention of fæces since the time of operation, for example twenty-four hours previously. If the bowel be distended by the injection of normal saline solution through the anus, reflex contraction of the bowel may be elicited and the fluid exuded together with a few scybala showing that the parasympathetic reflex is intact. Dilatation of the gut wall and contraction of the rectal sphincter when the enema is passed out, replaces the temporary contraction of the wall. If the hypogastric nerves be now removed or the ganglionated sympathetic cords in the lumbar region be excised, a change occurs. Immediately activity of the distal colon is resumed, the longitudinal muscle shortens and the circular fibres contract and the scybala are pushed on into a relaxed portion of the gut distal to the site of contraction. Evacuation is thus accomplished. A more localized effect may also be produced by removing only a few hypogastric nerve fibres at a time instead of excising the ganglionated cord. This may be done by ligaturing and cutting off small sigmoid vessels and their accompanying nerves, if care be taken to preserve an adequate blood supply to the gut. After each section a localized contraction of the gut occurs about one centimetre distal to the junction of the vessel severed and the gut wall. Branches of the superior hæmorrhoidal vessel were treated in like manner and defæcation proceeded. In one experiment it was noted that between active segments proximally and distally 2.5 centimetres of bowel remained greatly distended, containing seven scybala heaped up within it. Ligature and section of the nerves proceeding to this segment led to its active contraction. As the bowel emptied, it remained contracted and the three tænia formed three distinct bands upon its surface. These experiments conclusively prove that the retention of fæces in the first stage of complete transection of the spinal cord is due to a continuously acting inhibitory effect upon the distal colon brought about by a reflex arc through the hypogastric nerves; as a result of the removal of impulses from higher centres the normal balance of activity between the sympathetic and parasympathetic system is lost. For instance, it has been shown that stimulation of the sciatic nerve causes the defæcation reflex through the pelvic nerves, but transection of the cord at any level destroys this action. This points to the presence of a centre in the *medulla oblongata*.[22] The hypogastric nerves as a result of the loss of balance of action impose a posture upon the bowel which enables the contents to accumulate in it greatly in excess of what normally excites the reflex activity of the pelvic nerves. But when the sympathetic influence is removed, the pelvic nerves hold sway.

In Royle's first patient an interesting phenomenon followed section of the lumbar white rami of the sympathetic system of a similar nature to the experimental results obtained by removal of the hypogastric influence on the distal colon. Prior to the operation daily doses of 3.9 grammes of sodium sulphate were required to obtain any action of the bowels. Following the operation the bowels have acted without aperients always once, sometimes twice *per diem*. The sectioning of the white rami on one side was undertaken with some trepidation that unilateral removal of the hypogastric nerves would materially influence the bladder and rectal functions. In subsequent operations Royle intends to cut the grey rami only if the voluntary muscles alone need be operated upon; but the beneficial results obtained by sectioning the white rami and so removing the influence of the hypogastric nerves suggests that the sectioning of the latter nerves on one side may in some cases be of therapeutic value.

It is clear that the continuously acting inhibitory effect upon the muscle of the wall and the tonic contractile effect upon the internal sphincter lead to the filling of the bowel. The pelvic nerves which relax the sphincter and contract the gut wall, have the effect of emptying the bowel.

The hypogastric and pelvic nerves have a similar function to perform in at least some animals in controlling the bladder as that already described for the alimentary canal. Elliott[23] showed, for instance, that in the cat the hypogastric nerves "facilitate retention of urine" by constricting all the urethra and relaxing the bladder. The cat's bladder is a good example of this type of action because it is specialized for the storage of large quantities of fluid. The inhibitory reaction in the rabbit is less widespread, but in the experiments on rabbits detailed above in which the cord was first transected, the greatly distended bladder emptied upon excision of the ganglionated sympathetic chain. Elliott concludes that: "In all mammals the pelvic visceral or sacral nerves cause the whole bladder to contract; in the cat and rabbit and probably in others they also inhibit the sphincter." Elliott

calls these fibres the nerves of micturition. In general, therefore, the fundamental plan of the innervation of the bladder is the same as that of the gut. The filling nerves are supplied by the sympathetic system and the intermittently acting emptying nerves are parasympathetic in origin. The posture of these viscera is maintained by the sympathetic nervous system. It is to be noted also that the same system regulates the posture of the blood vessels supplying the viscera. In the filling stage the effect of the sympathetic outflow is to maintain the organ in that degree of relaxation necessary to accommodate the contents within it and during this inactivity the vaso-constrictor nerves maintain the posture of the blood vessels, so that no increase of blood is supplied to the part. In this sense the functions of these two sets of sympathetic nerves are not antagonistic, but complementary to one another.

General Summary.

If the phenomena discussed in the foregoing sections connected with the sympathetic innervation of voluntary muscles, blood vessels, including capillaries and hollow viscera, be reviewed in conjunction with one another, the general conclusion is arrived at that in each of these systems the sympathetic influence is continuously active. In voluntary muscle it produces plastic tonus which is subject to modification by the cerebro-spinal system. The constriction of arteries, arterioles, capillaries and venules is brought about by the same influence and may be inhibited by vaso-dilator nerves. The involuntary muscle of hollow viscera is maintained in that degree of relaxation appropriate to accommodate the contents within it and the sphincters are tonically contracted by the sympathetic innervation. The parasympathetic nerves intermittently stimulate the muscle of the wall and relax the sphincter. In each case the sympathetic system imposes a posture, in the sense of that word employed by Sherrington, on the structures innervated by it. It is possible to conclude, therefore, that this is a general and important part of the function of the thoraco-lumbar or sympathetic outflow.

References.

(1) A Perroncito: *Archives Italiennes de Biologie, Volume* XXXVIII., *page* 393 (quoted by Bayliss).

(2) J. Boeke: *"Beiträge zur Kenntniss der motorischen Nervenendigungen II., Die akzessorischen Fasern und Endplätchen," Internationale Monatsschrift für Anatomie und Physiologie*, 1911, *Band* XXVIII., *Seite* 419. *"Die doppelte (motorische und sympathische) efferente Innervation der quergestreiften Muskelfasern," Anatomischer Anzeiger*, 1913, *Band* XLIV., *Seite* 343.

(3) S. de Boer: *"Die quergestreiften Muskeln erhalten ihre tonische Innervation mittels der Verbindungsäste des Sympathikus (Thoracales autonome System)," Folia Neurobiologica*, 1913, *Band* VII., *Seite* 378, 837.

(4) S. de Boer: *"Die Bedeutung der tonischen Innervation für die Funktion der quergestreiften Muskeln," Zeitschrift für Biologie*, 1915, *Band* LXV., *Seite* 239.

(5) W. M. Bayliss: "Principles of General Physiology," 1920.

(6) J. W. Langelaan: "On Muscle Tonus," *Brain*, 1915, Volume XXXVIII., page 235.

(7) J. W. Langelaan: "On Muscle Tonus," *Brain*, 1922, Volume XLV., page 435.

(8) E. D. Adrian: "Muscular Tone and the Sympathetic System," *Medical Science Abstracts*, 1920, Volume II., page 454.

(9) Dusser de Barenne: *"Über die Enthirnungsstarre* (Decerebrate Rigidity Sherrington's) *in ihrer Beziehung zur efferenten Innervation der quergestreiften Muskeln," Folia Neurobiologica*, 1913, *Band* VII., *Seite* 651.

(10) Dusser de Barenne: *"Über die Innervation und den Tonus der quergestreiften Muskeln," Archiv für die gesammte Physiologie*, 1916, *Band* CLXVI., *Seite* 145.

(11) G. Van Rijnberk: *"Recherches sur le Tonus Musculaire et son Innervation." Archives néerlandaises de Physiologie*, 1916, *Volume* I., *page* 702.

(12) S. Cobb: "A Note on the Supposed Relation of the Sympathetic Nerves to Decerebrate Rigidity, Muscle Tone and Tendon Reflex," *American Journal of Physiology*, 1918, Volume XLVI., page 478.

(13) K. Uyeno: Proceedings of the Physiological Society, July 8, 1922, *The Journal of Physiology*, 1923, Volume LVII.

(14) F. M. R. Walshe: *Medical Science Abstracts*, 1921, Volume V., page 58.

(15) Report of the Eleventh International Congress of Physiology, *The Lancet*, August 4, 1923, page 252.

(16) C. S. Sherrington: "On Plastic Tonus and Proprioceptive Reflexes," *Quarterly Journal of Experimental Physiology*, 1909, Volume II., page 109.

(17) C. U. Ariëns Kappers: "The Ontogenetic Development of the Corpus Striatum in Birds and a Comparison with Mammals and Man," *Proceedings: Koninklijke Akademie van Wetenschappen te Amsterdam*, 1922, Volume XXVI., page 135.

(18) W. H. Gaskell: "On the Structure, Distribution and Functions of the Nerves Which Innervate the Visceral and Vascular System," *The Journal of Physiology*, 1885, Volume VII., page 1.

(19) A. Krogh: "The Anatomy and Physiology of Capillaries," Yale University Press, 1922.

(20) C. S. Sherrington: "Postural Activity of Muscle and Nerve," *Brain*, 1915, Volume XXXVIII., page 191. "The Integrative Action of the Nervous System," Yale University Press, 1920.

(21) T. R. Elliott and E. Barclay Smith: *The Journal of Physiology*," 1904, Volume XXXI., page 272.

(22) S. W. Ranson: "Afferent Paths for Visceral Reflexes," *Physiological Reviews*, 1921, Volume I., page 447.

(23) T. R. Elliott: "The Innervation of the Bladder and Urethra," *The Journal of Physiology*, 1907, Volume XXXV., page 36.

Reviews.

A NURSE AT THE WAR.

ALTHOUGH many books of fiction have been written about the war and readers have naturally become weary of them, there is an attraction about a personal narrative which cannot fail to hold the attention. Sister R. A. Kirkcaldie, in her book "In Gray and Scarlet," tells of her experiences while attached both to the Australian Mercantile Fleet Auxilliary "Grantala" and to the Queen Alexandra Imperial Military Nursing Service Reserve.[1] While with the former she saw service in German New Guinea. Her description of life on a hospital ship at Gallipoli as a member of the latter corps is interesting and the account she gives of the part played by her and others in the establishment of an efficient hospital service at Malta will well repay perusal.

In France Sister Kirkcaldie was attached to several units both at the base and in the forward areas with the casualty clearing stations. The word-picture which she paints of the rush work occasioned in these units by a "push," is most realistic. The book is well illustrated.

[1] "In Gray and Scarlet," by Sister R. A. Kirkcaldie, late of A.M.F.A. "Grantala"; 1923. Melbourne: Alexander McGubbin; Crown 8vo., pp. 187, with 23 illustrations.

The War Memorial of the Victorian Branch of the British Medical Association.

ON November 12, 1923, His Excellency the Earl of Stradbroke, Governor of Victoria, unveiled the beautiful war memorial erected by the members of the Victorian Branch of the British Medical Association. The empty hall destined to become the museum of the new Department of Anatomy was crowded with members of the Australasian Medical Congress (British Medical Association). Academic dress and military uniform predominated. On the floor surrounding the monument, a picture of which is reproduced on the opposite page, a guard of honour drawn from the members of the University Rifles stood with bowed heads and reversed rifles.

DR. L. S. LATHAM, the President of the Victorian Branch of the British Medical Association, said:

> Yesterday there was commemorated throughout the British world that supreme moment when the warring nations ceased from their struggle and the grim years of terror and tragedy, of waste and woe came to an end. We then joined in remembering in reverend silence those who had perished in the conflict.
>
> Today the Victorian Branch of the British Medical Association pays homage to forty-three of its members who, forsaking their civil work to tend the sick and wounded of their country's fighting forces, crowned their devotion with the supreme sacrifice.
>
> We are proud that their memorial is to be unveiled by His Excellency the Governor in the presence of representatives of the Governments of Commonwealth and State, of the Naval, Military and Air Forces, of the Army Medical Corps and of the British Medical Association in Great Britain, New Zealand and all the States of the Australian Commonwealth.
>
> In the minds of the relatives of those now commemorated this ceremony will reawaken the sense of personal loss and sorrow. But they may find comfort in the thought that this memorial at once attests and insures the remembrance of their kindred. The genius of the artist has associated their names in dissoluble fashion in the lasting bronze with a symbolic group portraying at once a soldier's sacrifice and a doctor's devotion.
>
> In the future the Branch may have a building worthy to contain the memorial. For the present we gladly leave it in this new school, where it may serve to inspire fresh generations of students and lead them as they study the structure of the human body to remember the higher virtues of citizenship and the service of sacrifice.

HIS EXCELLENCY then drew away the flag veiling the memorial; the guard presented arms and the Last Post was sounded.

The monument is the work of Mr. Web Gilbert. He was asked to convey the idea of the Army Medical Officer performing his duty and he has succeeded in endowing the bronze figures with an eloquent appeal and a touch of Nature. The members of the Branch have contributed generously in order that the "glorious dead" may be fittingly remembered. The dramatic setting of the ceremony will long be remembered by those who were privileged to witness it. The war memorial itself with its forty-three names inscribed on the pedestal will remain a perpetual reminder of men who placed duty before all else. The names that are engraved indelibly, are:

GEORGE GRANTHAM ANDERSON
FRANCIS SPENCER BOND
NORMAN JOHN BULLEN
SYDNEY JAMES CAMPBELL
ARCHIBALD GLADSTONE CORBETT
EDWARD WILKINSON DEANE
ARTHUR FRANCIS DERAVIN
GEORGE STEPHENSON ELLIOTT
JAMES FAIRBURN FAIRLEY
ALFRED RAYMOND FOX
WADE SHENTON GARNET
RICHARD HORACE GIBBS
HARRY FRANKLYN GREEN
EDWARD HARKNESS
ANDREW VICTOR HONMAN
GODFREY HOWITT
WILLIAM WESTON HEARNE
MELVILLE RULE HUGHES
JOHNSON HUGHSTON
DOUGLAS DUNBAR JAMIESON
FREDERICK MILLER JOHNSON
ERIC JOHN KERR
ARTHUR WELLESLEY LANGLEY
KEITH MAURICE LEVI
CHARLES ROY LISTER
JOHN GLADSTONE MACKENZIE
GORDON CLUNES MCKAY MATHISON
GEORGE PINNOCK MEEZ
ALBERT GUY MILLER
JAMES JOACHIM NICHOLAS
CHARLES JOSEPH OLIVER
LEONARD EDMUND WADSWORTH ROBERTS
WILLIAM ROGERSON
ARTHUR CECIL HAMEL ROTHERA
PHILIP BEACHAMP SEWELL
HAROLD SOUTH
CEDRIC ALWYN STEWART
HAROLD OSCAR TEAGUE
EDWARD RONALD WELCH
MALDWYN LESLIE WILLIAMS
ARTHUR HOLROYD O'HARA WOOD
LEONARD ALEXANDER WRIGHT
ROBERT PERCY YOUNG

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The Medical Journal of Australia

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A Retrospect.

Bacteriology and Immunology.

Each year the practice of medicine becomes more dependent on the doctrines of immunity, of pathology and of physiology. The clinician of last generation is struggling to save the hypotheses based entirely on observations in the ward and in the *post mortem* room, but little by little he is forced to acknowledge that evidence collected in experiment and checked in the clinic cannot be ignored. Since science means truth, a single proven fact is more valuable than a host of clinical impressions, however ingenious and skilled the observer. In the relatively new sciences of bacteriology and immunology great caution is needed in drawing conclusions and in making assertions.

The application of the complement fixation test to tuberculous infections has been investigated by many workers during the year 1923. Punch and Gosse have recommended the use of an emulsion of living tubercle bacilli as the most satisfactory antigen. They suggest that the varying results obtained by different workers who have employed this test, must be attributed to the use of different antigens. Bryce and Williams have employed an antigen composed of an emulsion of killed tubercle bacilli of both human and bovine types. Dreyer's defatted or diaplyte bacilli have been used by several workers, but there appears to be a diversity of opinion as to the advantage of such an antigen over those already in use. Goodpasture has investigated the complement fixation property of the serum of leprous patients and has employed human tubercle bacilli as his antigen. He has obtained evidence which indicates the possibility of controlling the cure of leprosy by the results of this test.

In the diagnosis of hydatid disease the immunity reactions have been carefully examined by K. Douglas Fairley and other workers at the Walter and Eliza Hall Institute for Research in Pathology and Medicine. The value of the complement fixation test in hydatid infections has been recognized for some time, but these workers advocate the employment of the Casoni intradermal test and the precipitin test as the most useful aids in the interpretation of the complement fixation test. One great advantage of the Casoni and the precipitin tests over the complement fixation test is that they can be carried out without difficulty by the general practitioner.

Many investigators, including Priestley, Dreyer and Ward, McIntosh and Fildes, Houston, Campbell, Smyth, Rankin, Hall, Stokes and Migham and Urquhart have devoted much time to a comparative study of the results of the Wassermann test and those of the flocculation test of Sachs and Georgi, later renamed the sigma test by Dreyer. All agree that the flocculation test yields results that are sufficiently accurate for clinical purposes. Some claim that the flocculation test yields results scarcely less reliable than the Wassermann test. It is simpler and more economical than the Wassermann test and it can be worked as a quantitative test.

Dreyer has extended the idea of partial antigens and in doing so has introduced a new principle into bacterial immunity. Hitherto the antibody response to partial antigens has been disappointing. Whether the deliberate removal of the lipoidal substances from the bodies of the tubercle bacilli leave specific substances which have the power of calling forth immune bodies in the living organism, remains to be seen. Dreyer kills the tubercle bacilli by exposure to heat, extracts the lipoidal substances with acetone and deprives them of their characteristic acid-fastness by means of formaldehyde. He claims that bacilli treated in this manner retain their antigenic properties. A mere retention of antigenic qualities would offer no enhanced therapeutic or prophylactic value as compared with whole tubercle bacilli or tuberculin. It is possible that the cytoplasm of the bacilli induces antibody response only after disintegration. If the products of dissociation are specific, it would be possible that the diaplyte vaccine of Dreyer might be endowed with power to produce immunity. While there does not appear to be any theoretical argument based on ascertained fact in favour of this form of partial antigen, more information is required before a final judgement can be passed.

The subject of iso-agglutinins in human blood has received considerable attention during the past twelve months. Guthrie and Huck, by demonstrating the presence of three agglutinins and three agglutinogens in human blood, have presented a possible solution of the post-transfusion reactions which sometimes occur in a recipient when the donor has been selected according to Moss's method. Irvine McQuarrie, working on the subject of iso-agglutination in new-born infants and their mothers, has produced data suggestive of the existence of some relationship between the incompatibility of maternal and fœtal blood on the one hand and the pre-eclamptic condition on the other.

The bio-chemical race index of the Koreans, Manchus and Japanese has been established by Hozumi Fukamachi, that of the natives of New Guinea by G. M. Heydon and that of the Australian aborigines by Tebbutt.

The subject of the phenomenon of bacteriophagy or microbic transmisslble autolysis is continuing to receive the attention of bacteriologists and biologists. Twort and d'Herelle have suggested as an explanation of the phenomenon the presence of an invisible filtrable virus which lives as a parasite on various bacteria and is capable of causing their disintegration. Bordet and Cuica, on the other hand, regard the phenomenon as an autolysis, the consequence of a nutritive vitiation of the bacterial metabolism. Both these hypotheses will have to be supported by indisputable evidence.

Caronia and Sindoni in Rome and G. F. and G. H. Dick in America claim that they have produced evidence in support of the view held by many bacteriologists that a hæmolytic streptococcus is the causal organism of scarlet fever. Caronia has also described a small anaerobic diplococcus which passes through an ultra-microscopic stage, as the organism responsible for morbilli.

Lister reports the recovery of an anaerobic, filter-passing organism similar to that described by Gates and Olitsky in New York, in connexion with influenza. His preliminary experiments on human volunteers appear to indicate the possibility that it may have an ætiological relationship to the disease.

Opthalmology.

Campbell, Carter and Dout in America have broken new ground by instituting an examination of the lachrymal passages of sixty patients with the aid of X-rays after injection with oil and bismuth. The passages were shown to exhibit gross and bizarre variations in size and form. They are of opinion that after failure of partial removal of the lachrymal sac X-ray examination may afford valuable information in regard to the nature of further operative treatment.

Ophthalmology has been usefully extended into the sphere of preventive medicine. A copious literature has been issued by the Illuminating Society of Great Britain, by the sister society in the United States of America and by the Bureau Internationale du Travaille on the lighting of factories as a means for the prevention of accidents and on the hygiene of the eye in general.

Ophthalmia neonatorum still presents a tragic problem, the solution of which is not in sight. It has been stated that in America preventive measures adopted during the last twenty years have failed to prevent or even to diminish the amount of blindness from this disease. Excellent work in this connexion has been carried out at Saint Margaret's Hospital in London; workers elsewhere would do well to imitate it.

Robson has published a new hypothesis of the cause of miners' nystagmus. He holds that there is a direct relation between the incidence of the condition and the presence of volatile bodies in the coal seams. In the Monmouthshire mines where the volatile content is given at 29.5% no less than 4.56% of the miners suffer from nystagmus, while in the Carmarthen mines the volatile content is 11.86% and only 1.5% of the miners suffer from nystagmus. Highly bituminous coal gives rise to dust which oxidizes readily with the formation of carbon monoxide gas. The Second Report of the Miners' Nystagmus Committee of the Medical Research Council has been issued in August. The members of this committee still adhere to the opinion that defective lighting is the essential cause. Pooley has demonstrated after investigation that refractive errors have no effect whatever on the incidence of the disease.

In dealing with the operation of trephining for glaucoma, Foster Moore claims that by applying a continuous suture along the whole of the conjunctival wound the cyst-like bleb which mars this operation, can be avoided. This bleb is an indication of defective drainage and it constitutes a danger of late infection. He maintains that by suturing the conjunctiva the anterior chamber is rapidly reformed and a wide area of filtration is thus insured.

Irido-encleisis appears to be gaining favour as an effective means of maintaining normal tension. In advocating this procedure Herbert calls attention to the necessity of covering the prolapsed iris adequately with connunctiva.

Ida C. Mann has continued to publish most interesting and useful work on the development of the eye.

Urology.

The subject of the treatment of carcinoma of the bladder has been dealt with by many surgeons during the year. Bugbee, Young, Scott and Smith have formed the opinion based on their experience that partial resection of the bladder still remains the best method of treatment of cancer of the upper half of the organ, while for new growth in the lower half they prefer exposure to radium and diathermy. It is held that this form of treatment has advantages over surgical interference in areas in which the primary growth and the regional lymphatic glands cannot be removed with completeness and certainty.

Harnagel has instituted a new use for the cystoscopic *rongeur* forceps. In stenosis, uretero-vesical cyst and calculus of the intra-mural part of the ureter in the female this instrument is made to grasp the intra-mural ureter. This is drawn as far as the vulva through the short female urethra. The rest of the treatment can then be performed with ordinary surgical instruments under the guidance of sight.

In the past two years there has been a revival of interest in the phenomenon of reflux of the vesical contents along the ureter. Graves and Davidoff have conducted an extensive series of experiments with the object of demonstrating the conditions under which ureteric reflux may take place. They have shown that a state of good tone of the bladder is essential. Reflux occurs more readily when the bladder is empty and contracted or rested than when the organ has been distended with large amounts of urine. Injury to the ureter does not seem to influence the production of reflux. The investigators have observed the occurrence of ureteric reflux as a result of acute urinary obstruction.

Some work has been carried out in connexion with the relation of the intestine and the renal tissues in infections. In the course of experiments bacteria were recovered from the mesenteric glands in more than half the number of dogs. The commonest organism was *Bacillus coli communis*. The same organisms were injected into the intestine after the walls had been injured and obstructed. The result was a violent infection of the mesenteric glands. In almost every instance the blood stream and the urinary tract remained uninfected. No evidence has been adduced that bacteria pass from the intestine through the mesenteric glands to the kidneys by way of the lymphatic channels, save in some rare instances in which the bowel is diseased and in actual contact with the peritoneal covering of the kidney.

Legueu and Rochet have called attention to the occurrence of pelvic cellulitis in the male resulting either from a suppurative focus in the prostate or the deep segment of the urethra or from an infection originating in trauma during operations on the bladder. They have described a special technique for the purpose of obtaining dependent drainage in the perineum.

Young has published the results that he has obtained of operations through the bladder for the cure of vesico-vaginal fistulæ. He claims that this transvesical route yields better results than the usual vaginal operation.

Negro is of opinion that the blood count is of use in the differential diagnosis of neoplasms of the prostate gland. In simple senile hypertrophy there is usually an eosinophilia without any change in the number of poly-morpho-nuclear leucocytes. In carcinoma of the prostate eosinophilia is less frequent, while the number of poly-morpho-nuclear cells is always increased.

Potel and Cordier have conducted some researches into the cause of the greater mobility of the right than of the left kidney. They have come to the conclusion that ptosis of the kidney is due to relaxation of the renal capsule and descent into a preformed space. As the left colic flexure is well fixed in the majority of persons, while the right colic flexure is often mobile, the kidney on the right side tends to become mobile. They have shown that ptosis of the intra-peritoneal viscera is determined by the descent of the kidney and that the whole process is intimately connected with developmental anomalies.

Biological Chemistry.

In a general review of the year's work it occasionally happens that one subject may have engaged the attention of workers in two or three fields. In 1923 the subject of "Insulin" has claimed the consideration of the bio-chemist, of the physiologist and of the therapeutist. Consequently reference to this matter will be found in three chapters of this review. Banting and Best have shown at an early stage that extracts of the degenerated pancreas which no longer contain trypsin or its progenitors, produced a diminution in the concentration of glucose in the blood some hours after subcutaneous injection. Collip has further demonstrated that alcoholic extracts of fresh ox pancreas contains an ingredient endowed with similar action. The hypothesis has been advanced that the pancreas forms a substance which is concerned with the oxidation of glucose. This substance is destroyed by tryptic digestion. The presence of this substance in the blood is said to lead to hypoglycæmia.

During the year numerous studies have been carried out in every part of the world. The belief that a remedy had been discovered for *diabetes mellitus* led to the manufacture of "Insulin" (that is an extract of pancreas deprived of its proteolytic powers by a process patented by Banting, Best and Macleod) in almost every country. In Australia this substance has been made on a large scale at the Commonwealth Serum Laboratories under the able direction of Dr. Penfold. The standard suggested by Banting, Best, Collip, Macleod and Noble has been adopted. According to this standard the unit is the quantity of extract measured in cubic centimetres which will lead to a reduction of the concentration of glucose to 0.045% within four hours in the blood of a normal rabbit. In routine standardization of manufactured "Insulin" the time taken to produce convulsions after subcutaneous injection into rabbits has been used as a means of judging its potency.

Numerous contributions have been made toward the elucidation of the vexed question of the causation of rickets. McCollum and his collaborators have advanced further evidence in favour of the existence of a fat-soluble vitamin D, differing from the well known fat-soluble vitamin A. To this substance they ascribe the capacity of facilitating the deposition of salts of calcium in cartilage during the period of bone formation. More interest has been taken in the discovery that exposure to direct sunlight or to radiations from a mercury vapour lamp delays the onset of xerophthalmia and the cessation of growth in rats fed on diets deficient in fat-soluble vitamin A. Rats which have ceased to grow as a result of the withdrawal of butter fat from the ration, increase in weight on the same diet if they are exposed to direct sunlight or the light from a mercury vapour lamp.

A valuable study of the zymolysis of urea has been conducted by Fearon. He has investigated the action of urease, in view of the fact that the carbamide formula does not represent the structure of urea with any degree of accuracy. He holds that a better representation is given by the formula $HN=C<\begin{matrix}NH_2\\O\end{matrix}$ Fearon regards urease as a dissociating enzyme which splits the neutral molecule of urea into an alkaline component, ammonia and an acid component, cyanic acid. Cyanic acid undergoes rapid hydrolysis into ammonia and carbon dioxide. It is suggested that this enzymic decomposition proceeds along the same lines as the decomposition of urea in solution by acids, by alkalis and by heat.

Radiology.

In that part of radiology that is concerned with diagnosis no new principles have been introduced during the past twelve months, although steady advance in detail can be recorded. In gastro-intestinal radiography the serial film has gained in favour. This has proved of special value in the study

of the duodenum. Pneumo-peritoneum is losing favour. The success anticipated from its use has not been fully justified. It is now reserved for special conditions, such as retro-peritoneal tumours. Many workers have contributed papers on the normal peristalsis of the gastro-intestinal tract by means of examination with the aid of bismuth or barium meals and of opaque enemata.

Radiography of the chest has advanced. The majority of radiographers take chest skiagrams at a distance of a hundred centimetres from the target with very short exposures. In this way blurring of the lung markings can be avoided. All agree that lung lesions are very difficult to interpret. Pulmonary tuberculosis is frequently diagnosed when simple catarrhal conditions are present. It is not always possible to distinguish active from healed tuberculous lesions. Inexperienced practitioners are prone to diagnose pneumonoconiosis and silicosis in lungs when the skiagrams reveal merely some increase in markings and when the signs should be regarded as evidence of recurrent bronchitis or of pulmonary congestion.

Routine examination of the skull after injuries has become general. The actual lesion and its extent in fracture of the skull can be demonstrated in nearly every patient. Abnormalities of the *sella turcica* have been reported on many occasions. In this class of work stereoscopic radiography has proved very useful. It has been shown that *petit mal* in young people is usually associated with smallness of the *sella turcica*. The administration of pituitary extract is often followed by the disappearance of the *petit mal*. Brain tumours with calcification have been demonstrated on many occasions. Ventriculography or injection of air into the cerebral ventricles has been found to be of value in the diagnosis of such brain lesions as hydrocephalus and tumours in children.

In regard to new apparatus little advance has been made in connexion with the generating units. The makers are producing transformer machines of the oil-immersion type for the production of high *milliampèrages* at kilovoltages of from forty to one hundred thousand. Coronaless aerials have become general. By their means the amount of ozone in the neighbourhood of X-ray machines has been sensibly reduced and a more healthy atmosphere has been supplied for X-ray workers.

In the matter of radio-therapy the deepest interest has been given to the intensive radiation of tumours by highly penetrating rays. Although radiologists generally have failed to produce statistics equal to those claimed by the workers at Erlangen, the method had gained in favour and it is becoming recognized as valuable in attacking malignant disease, especially the sarcomata. Sarcomata yield readily to X-radiation, even when the tumours invade bone. Many well-established cures have been reported. The carcinomata are more resistant and the results have been disappointing except carcinomata of the uterus. When the transformer apparatus and Coolidge tubes are used, dosage can be measured with accuracy. The length of exposure is still unduly long, owing to the limitation of the tubes. An experimental water-cooled Coolidge tube has been constructed. This tube will carry a load of thirty *milliampères* for long periods at three hundred thousand volts. Too many patients with hopelessly advanced malignant disease are submitted to X-radiation. Cachectic patients should not undergo this treatment nor should those who have secondary growths. Attempts have been made to carry out this treatment by practitioners who have not been trained as radiologists. Failure has inevitably resulted, as the work demands special knowledge of the process which only an expert will possess.

Much discussion has taken place concerning the place of X-ray treatment in exophthalmic goître. At the Australasian Medical Congress (British Medical Association) the majority held that surgical means offered the best results. The radiologists, however, maintain that Graves's disease in its early stages can be cured by X-radiation of medium intensity in divided doses. Adenomatous goître should be treated by surgical measures; radiation treatment is only advocated for the relief of symptoms before operation. Prostatic enlargement has been successfully combated by means of X-rays with divided doses applied through the perineum. Similarly the X-ray treatment of enlarged tonsils and adenoid vegetations has yielded good results in the hands of many radiologists. It is advocated for adults and persons with hæmophilia.

Abstracts from Current Medical Literature.

DERMATOLOGY.

Inflammation.

L. TÖRÖK (*Archives of Dermatology and Syphilology*, October, 1923) states that as a result of numerous investigations and discussions it has been established that inflammatory changes at times occur in the blood vessels, at times in other elements of the tissue, especially in its cells, and at other times in both tissue elements and the blood vessels. They are produced by the direct influence of the pathogenic agent. Hence it is erroneous to consider any one of them the primary inflammatory lesion and the others as merely resulting from it. The supporters of the teleologic theory seek to prove that the inflammatory process is a defence reaction of the organism against injury to the tissues. The observation of skin diseases often furnishes evidence, however, that inflammation produces conditions favourable to the establishment of pathogenic bacteria. For instance, pyogenic organisms on the inflamed skin in artificial dermatitis cause the development of purulent processes. Contrary to Cohnheim the author believes that the proliferation of cells and subjective complaints must be attributed primarily to the action of the noxious agent and comes to the conclusion that inflammation is a reactive disturbance of the blood vessels which causes an excessive congestive hyperæmia, an abnormal exudation of fluid rich in albumin and migration of white and red blood cells. This is produced by noxious influences the intensity of which is weak or diminished to such a degree that they are unable to produce any alteration in the tissues of such importance as atrophy, hypertrophy or necrosis. The reactive disturbance of the blood vessels which furnishes the basis of inflammation, is only one kind of reactive alteration which can be produced by the weakened noxious agents. This action involves also proliferative alterations of the fixed cells of the tissues which is called reactive proliferation and symptoms of reactive irritation of the sensitive nerves, such as pain, itching and burning.

Lupus Erythematosus.

KNOWSLEY SIBLEY (*The Urologic and Cutaneous Review*, July, 1923) states that *lupus erythematosus* is now considered to be an external expression of an internal constitutional disturbance, a toxic erythema, and far more closely allied to *erythema multiforme* than to lupus. The treatment is both internal and external. Septic foci should be located. Any infected tonsils or teeth should be removed and, if a streptococcus is present, an autogenous vaccine will often prove curative.

Pigmentation of the Skin.

MARTIN ENGMAN (*Archives of Dermatology and Syphilology*, October, 1923) describes an hereditary pigmentation of the skin associated with one leg in the lower third and never atrophy. The condition is limited to affects both legs. The disease may be handed down from either the male or female ancestor, but usually from the latter. It generally occurs in the lower walks of life and may occur in the male, although it is much more common in the female. It usually begins from the twenty-fifth to the thirty-fifth year. The first sign is a follicular pigmentation of the lower third of the leg in the form of dots of yellowish sago grain pigment irregularly scattered over that portion of the extremity. These patches coalesce into larger patches of various shapes and sizes. There is usually no pruritus. As the pigment tends to increase, it undergoes changes of colour varying from yellow to dark brown. Slight atrophy is discernible after it has existed from three to five years. There has been no analogy found between this condition and *purpura annularis telangiectoides* or the progressive pigmentary dermatoses described by Schamberg.

Fox Fordyce Syndrome.

ARTHUR WHITFIELD (*The British Journal of Dermatology and Syphilis*, November, 1923) states that the salient features of the Fox Fordyce syndrome is the presence of pinhead sized, circular, domed papules affecting the hairy regions of the axillæ and pubes and associated with intense itching. Histologically there is hyperkeratosis of the sweat pores and hair follicles, chiefly of the former. There are also acanthosis, mechanical dilatation of the sweat glands and chronic inflammation of the derma. The author suggests that the syndrome is dependent on suprarenal deficiency and on this assumption is administering pluriglandular extract to affected persons.

Xanthoma Diabeticorum.

MARTIN ENGMAN AND RICHARD WEISS (*Archives of Dermatology and Syphilology*, November, 1923) report an instance of *Xanthoma diabeticorum* which responded rapidly to "Insulin." The treatment consisted of large doses of "Insulin" together with the intravenous injection of an 8% solution of bicarbonate of soda and the usual dietetic measures.

Mycelial Filaments in Skin Scrapings.

ISAAC PELS AND S. BAYNE-JONES (*Archives of Dermatology and Syphilology*, July, 1923) draw attention to a possible mistake in diagnosis of elastic tissue and mycelial filaments in skin scrapings. They record the results of examination of two instances, one a fungating granuloma of the leg and the other of a deep ulcerating granuloma. Fresh preparations from these lesions in hydroxide solutions revealed tissue which strikingly resembled mycelial filaments, but on more complete examination proved to be elastic tissue fibres.

Lichen Planus.

DOUGLASS W. MONTGOMERY AND GEORGE CULVER (*Archives of Dermatology and Syphilology*, July, 1923) call attention to the similarity of *lichen planus* to an infective disease, especially syphilis. They point out that one of the great dangers in making a diagnosis is that the condition may be confused with syphilis especially if the lesions are on the genitals. Taking the histories of one hundred and fourteen patients they found that 18% had had this eruption on the *glans penis*. As this location is not frequent it may be important to differentiate it from psoriasis, eczema and occasionally from leucoplakia.

Bullous Eruptions.

F. WISE AND J. ELLIS (*Archives of Dermatology and Syphilology*, May, 1923) report two instances of bullous lesions appearing in a patient with multiple hæmorrhagic sarcoma of Kaposi and in a patient with *lichen planus*.

Injections of Turpentine in Skin Diseases.

OSCAR LEVIN AND EMIL ROSE (*Archives of Dermatology and Syphilology*, November, 1922), as the result of a considerable amount of experimental work, recommend intramuscular injections of turpentine in the treatment of certain skin diseases. They found that it was of considerable value in pyogenic infections, especially with follicular involvement. Good results were recorded in *tinea barbæ*. The effect is both local and general. Locally there is apparently cell irritation, while the vital centres in the medulla are reflexly stimulated.

Cutaneous Capillaries.

S. E. DORE (*The British Journal of Dermatology and Syphilis*, November, 1923) states that within recent years light has been thrown upon two main factors which are fundamentally concerned in the production of cutaneous reactions. These are contractility of the cutaneous capillaries and the control of the capillary circulation by the nervous system. A patch of erythema of the skin, whether it is produced by heat or cold, by pressure or by nervous or toxic influences, is essentially a local hyperæmia caused by dilatation of the capillaries and an increased flow of blood through them. Until a few years ago capillaries were regarded as elastic tubes undergoing passive distention in accordance with general blood pressure, the state of contraction or dilatation of the supplying arterioles and the nutrition of the vascular wall. There is now, however, conclusive evidence that the capillaries play an independent part in the peripheral circulation, that they

possess the intrinsic property of relaxation and contraction and are under the direct influence of the nervous system. The author thinks that this evidence, which rests chiefly on the work of Dale and Bayliss in England and Krogh and his co-workers abroad, cannot fail to modify the conception of cutaneous reactions and will in some measure help to explain their pattern and distribution.

RADIOLOGY.

Osteo-chondritis Deformans.

B. R. KIRKLIN (*American Journal of Roentgenology*, September, 1923) reports several instances of *osteo-chondritis deformans juvenalis*. More than three hundred and fifty cases have been reported since 1915 and the names of Legg, Calvé and Perthes have been closely associated with this condition. The condition of great numbers of patients, originally diagnosed as tuberculosis of the hip, has now been proved to be *osteo-chondritis deformans*. The condition occurs principally in the first decade and is commoner in boys than in girls. Frequently the parents give a history of recent injury. The onset is insidious, the first symptom being a slight limp of intermittent nature with little or no pain. The limp may last for some years and shortening and atrophy may occur. The affection usually ends in recovery with a remodelled joint, the head of the femur being flattened and the outline of the acetabulum altered. Ankylosis and fixation in flexion and abduction are uncommon in this disease, but common in tuberculosis. In the skiagram the flattening (or crushing) of the epiphysis with broadening of the neck of the femur presents a characteristic appearance. The epiphysis may be divided into several pieces. The joint itself is clearly seen. The neck of the femur tends to shorten and the bone manifests signs of increased density.

Mediastinal Glands.

LLOYD B. CROW contributes an article on the radiological examination of the posterior mediastinal glands in the early recognition of pulmonary tuberculosis (*American Journal of Roentgenology*, September, 1923). He points out the difficulty experienced in the early diagnosis of tuberculosis in spite of recent advances in methods of examination. The glands of the posterior mediastinum are intimately associated with the hilar glands and form a continuous chain by the side of the aorta and œsophagus; they communicate on each side with the intercostals and with the lumbar and deep cervical glands. He recommends the adoption of the oblique position with the patient facing the tube and the screen over the left scapula, as in this position the greatest illumination of the post-cardiac space may be obtained. When glandular infiltration is present the space appears dark while in some instances a distinct line of enlarged glands may be demonstrated. These enlarged glands in tuberculosis form chains and have the appearance of scattered shot. In fibroid types of phthisis the posterior mediastinal glands are more extensively involved than in other types. When non-involvement of the glands occurs, it is practically certain that tuberculosis is not present.

Non-Luetic Periostitis.

ROY G. GILES (*American Journal of Roentgenology*, August, 1923) deals with various periosteal affections not due to syphilis. Periosteal bone production is a manifestation of the reaction of the periosteum to some irritant and is seen in fractures, trauma without fracture, osteomyelitis, typhoid fever, leprosy, rickets and the proliferative type of bone tumours. When the periosteum is stripped in fractures there is a gradual deposit of mineral salts which cast shadows in from one to four weeks, but this condition is rare. In the author's opinion traumatic periostitis which casts a shadow on the plate, is always accompanied by an infection. Osteo-myelitis is always accompanied by a periostitis. In tuberculosis the periosteum is involved only as the result of secondary infection and when periosteal reactions occur in tuberculosis, they are indistinguishable from the changes occurring in osteo-myelitis. In children there is frequently a tuberculous infection of the phalanges in which there is definite involvement of the periosteum. Typhoidal lesions are usually circumscribed cortical areas of rarefaction with surrounding condensation and extensive periostitis. In *osteitis deformans* there is thickening of the cortex, lime salts are deposited beneath the periosteum and new bone is laid down parallel with the cortex. In neoplasms of bone the new bone formation usually occurs at right angles to the cortex.

X-Rays and Sterility.

J. BELOT (*La Presse Médicale*, July 21, 1923) considers the effect of radiation on the genital organs. It has been definitely proved in the case of animals that single radiations will temporarily arrest the reproductive function of the testicles and ovaries without appreciably diminishing their activity. In an investigation amongst workmen in Germany employed in the vicinity of X-ray tubes in action. it has been shown that a temporary azoospermia exists. In the case of the ovary total destruction of the reproductive elements can be caused by large dosage of X-rays and amenorrhœa produced. There is a considerable variation in the susceptibility of individuals to radiations and repeated small dosage will produce sterility. The author finds that sterility in medical radiographic workers is uncommon. Of twelve medical men employed in radiography for from fourteen to twenty-five years and known to the author none were childless, while the average family was 3.7 and all the children were healthy. In the author's clinic and in the clinics of several other French radiologists the married lay staff all have from one to four children. The author thus concludes that with reasonable care radiologists run no risk of sterility in their occupation.

Cardiac Pneumo-Fibrosis.

GEORGE W. HOLMES AND DAVID S. DANN discuss the subject of cardiac pneumo-fibrosis (*American Journal of Rontgenology*, May, 1923). They attempt to explain the confusing shadows seen in the neighbourhood of the lung hilum. Clinically the picture of cardiac pneumo-fibrosis as the result of valvular disease of the heart may closely resemble tuberculosis even to the extent of hæmorrhage, but hitherto little has been written on the radiographic appearance. The film in these conditions has a sort of "washed-out" appearance which gives the impression of faulty technique, while there is an increase in markings from the hilum towards the periphery which gradually fade as the periphery is reached. The borders of the hilar shadow are indefinite and hazy, but there is absence of "beading." Larger irregular areas of increased density are common in the lower lobes, while coarse mottling is common. The diaphragm is well defined, but is usually limited in excursion. The heart shadow is of importance as it generally shows the mitral configuration. The authors discuss the differential diagnosis from pneumonoconiosis, secondary carcinoma and tuberculosis.

Pneumo-peritoneum.

H. H. CABELLI (*American Journal of Roentgenology*, April, 1923) contributes an article on pneumo-peritoneum. The author has carried out eight hundred examinations by this method in his private office without untoward result and without assistance. Contra-indications to the use of this method are old age, cardiac troubles, cachexia, obesity, acute inflammation, hysteria and the occurrence of a large tumour which prevents further distension of the abdomen. Patients are first purged by castor oil, this is followed by a saline aperient and a watery diet. The needle is inserted about three centimetres below the umbilicus unless scarring is present. A long thin platinum needle is used and oxygen is not introduced until it is certain that no blood issues from the tube. Oxygen is introduced slowly and the quantity varies from two to eight litres. The patient must not make active movements, but must be placed in the necessary positions by means of an elaborate adjustable table which is illustrated in the article. After the examination the oxygen is withdrawn and the patient is able to walk away from the table. A series of skiagrams illustrate the contribution.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE NEW SOUTH WALES BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Department of Anatomy, Medical School, University of Sydney, on October 26, 1923, DR. C. H. E. LAWES, the PRESIDENT, in the chair.

The Treatment of Spastic Paralysis.

DR. N. D. ROYLE read a paper on a new operative procedure in the treatment of spastic paralysis and its experimental basis and illustrated his subject by means of the demonstration of animals on whom experiments had been performed, of patients who had been subjected to the operative treatment, of cinematograph pictures and of lantern slides (see page 77).

PROFESSOR JOHN I. HUNTER read a paper on the tonic influence of the sympathetic nervous system (see page 86).

DR. C. H. E. LAWES welcomed Sir William Macewen and Dr. William Macewen to the meeting. He pointed out that they were particularly honoured by Sir William Macewen's presence, not only because of his eminence as a surgeon and as a scientific investigator in many fields, but especially because he was the immediate Past President of the British Medical Association and was present in Australia as the representative of that great organization at the Australasian Medical Congress.

SIR WILLIAM MACEWEN, C.B., F.R.S., said that he had listened to Dr. Royle's and Professor Hunter's papers and demonstrations with great pleasure. It was a feast, not a small meal and would require time for its digestion. He had been in the habit of giving his students a little bit at a time. That evening he was in the place of the student himself and he felt that he had had too much. He hoped that Professor Hunter would not overfeed his students, but give them small amounts to absorb at one time.

He had for long been interested in Sherrington's work. While he had no difficulty in following all that the speakers had said in regard to the experimental work on animals, he hesitated before he claimed that he had grasped the entire significance of the work on man. It would take too long to enter into a discussion on the physiological action of the *corpus striatum* and the cerebellum in relation to the diagnosis of cerebral tumour. Just before he had left for Australia he had performed an operation for the removal of a large tumour below the tentorium. During the operation they had experienced very considerable anxiety; the patient had shown signs of impending dissolution and recourse had been had to artificial respiration. He had responded to this measure. The motion of the muscles had returned very slowly. The vagus had been chiefly affected. The patient had recovered and when last seen had been in a vigorous condition.

Sir William Macewen referred to the restrictions placed on animal experimentation in the old country. He did not know what the law was in Australia, but he hoped that it was less irksome than in Great Britain. He congratulated the members on having at their disposal the newest methods of demonstration. The cinematograph, the modern projection apparatus and so on had impressed him. He had been told that the members of the medical profession in Australia thought that they were out of the world, far from the centres of thought and study. He had come to the conclusion that they had no cause for complaint. They had elbow room. They had people to stimulate them to do good work and people to do the work properly. Every investigator had to isolate himself to some extent. Research work became impossible when the worker was constantly subjected to interruptions and diversions. He thanked the members for the reception they had given him and concluded by congratulating Dr. Royle and Professor Hunter on their excellent work.

PROFESSOR A. E. MILLS tendered his congratulations to Dr. Royle on his important research and thanked both him and Professor Hunter for their highly interesting papers and demonstrations. He said that those who had to teach neurology and the physiology of the nervous system, might not have difficulty in following all the points raised in the course of the papers and in appreciating the reasons which had induced Dr. Royle to undertake these researches. But it might be very difficult for others to follow. Dr. Royle had removed the sympathetic in the course of treatment and had demonstrated that part played by it in the maintenance of tonus. It was possible to show the action of the sympathetic on voluntary muscle without removing it. In the first place he instanced the appendix. The fibres of the tenth thoracic segment passed to the cord from the cranium with the lateral column and passed on to the voluntary muscles of the abdominal wall. When the appendix became inflamed rigidity of the abdominal wall appeared and was tonic and persistent. This illustrated the principle that Professor Hunter had enunciated. The irritation of the splanchnic led to an increase in the plastic tonus of the muscles of the abdominal wall. Again in exophthalmic goitre the widening of the palpebral fissure could be explained in a similar manner. The endocrine glands had a sympathetic innervation. When the sympathetic was involved in the disturbance of the balance of the endocrine glands, the response was manifested through the third cranial nerve.

In the next place Professor Mills discussed the various phases of the knee jerk. He spoke of the hypotonicity of the extensors of the leg in the presence of a cerebellar lesion. The knee jerk continued for an inordinately long time and the phenomenon was of the nature of a lengthening reaction. In chorea the limb often remained extended for a considerable time and fell gradually under the influence of gravity. He also endeavoured to explain the tremor of exophthalmic goitre which he described as a riotous, uncontrolled movement. When the patient endeavoured to grasp with his hand, there was disharmony in the endeavour to control the movements. If the tremor could be removed, the muscles would be found to be in a condition of wanting tone. Professor Hunter had not claimed that he had exhausted all the conditions concerned in the maintenance of plastic tonus. Professor Mills referred briefly to the several spinal tracts, such as the vestibulo-spinal tract. If one of these tracts were put out of action or over-stimulated, there followed an interference with the postural tonus. From considerations of the morphology of these structures in their relation to the sympathetic, it was clear that the somatic nerves were not alone concerned with its maintenance. Incidentally he mentioned the effect of a knock-out blow in the ring, when, as the result of undue stimulation of the splanchnic, a muscular athlete was reduced to a toneless mass immediately. He regretted that he was unable to discuss the question from the physiological aspect.

DR. R. GORDON CRAIG, in thanking Dr. Royle and Professor Hunter for their splendid demonstrations, said that the Medical School at their University was emerging from its infant into its adult life and was providing them with workers of considerable merit. Formerly they had been content to depend for their scientific information on the researches conducted in the old world. Now they had among them men who were able to contribute to knowledge. Osler had once said that the temptation for practitioners to enter private practice was so great that their men had no time to work at research. The same had obtained in Sydney up to the present. Yet the McGill University men had contributed largely to the common fund of knowledge. The two men who had spoken that evening, had demonstrated that the same could be said of the graduates of their own University.

DR. KEITH INGLIS asked Professor Hunter whether any work had been done to demonstrate the application of the same principles that governed normal structures, in connexion with pathological tissues. He instanced the newly formed capillaries in certain neoplasms, such as the angiomata.

In his reply DR. ROYLE first of all wished to express his sincere thanks to those who had, as it were, stood in the background. He was under a debt of gratitude to Dr. Hoets who had rendered invaluable assistance in adminis-

tering the anæsthetics by the intra-tracheal method. He had helped them considerably in carrying out this difficult work. Then he wanted to thank Mr. Schaefer and Mr. Jamieson who had worked willingly and admirably, often under adverse conditions. He had also to express his indebtedness to Profesor Hunter who had supervised the plan of the experiments and had assisted in interpreting the results. His assistance had also been invaluable in planning the surgical operation.

PROFESSOR HUNTER thanked those who had taken part in the discussion. He also wished to express his thanks to the assistants, Messrs. Schaefer and Jamieson. He reminded Dr. Craig that a considerable amount of first class research in morphology had been undertaken for many years in the Department of Anatomy. He admitted that hitherto little investigation had been made into the clinical aspects of medical work. Professor Wilson and Professor Hill had both earned the distinction of the Fellowship of the Royal Society by their work in the University of Sydney.

In reply to Dr. Inglis he said that it was quite probable that the principles of which he had spoken, applied to pathological capillaries. A. Krogh whose work on the capillary-motor mechanism had gained him the Nobel Prize for Physiology in 1919, had not dealt with the capillaries of pathological tissues.

A MEETING OF THE SOUTH AUSTRALIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held in the Lister Hall, Hindmarsh Square, Adelaide, on November 29, 1923, DR. STEELE SCOTT, the VICE-PRESIDENT, in the chair.

Nasal Polypi.

DR. H. M. JAY exhibited a nasal polypus of considerable interest from the point of view of the clinician. The patient from whom it had been removed, had stated that something had been hanging in the back of his throat for some years. Examination with a post-nasal mirror had shown a large nasal polypus dependent in the naso-pharynx. Examination through the anterior mares had revealed no abnormality, but by using a rhino-pharyngoscope it had been possible to see the antral ostium on the right side and issuing from it a band of tissue which when traced backwards could be seen to become broader until it merged into the polypus in the naso-pharynx. The maxillary antrum had been opened through the canine fossa and had been found to be lined with perfectly normal mucous membrane. A thin flat band of tissue had been found springing from the anterior face of the maxilla just above the opening into the canine fossa. This band had been four millimetres in width and had traversed the antral cavity and disappeared through the ostium. The band had been divided at the base and the whole of the growth had been withdrawn through the nose. Its length was seven centimetres. Dr. Jay said that the occurrence of these choanal polypi was by no means uncommon, but he thought it was worth exhibiting as it demonstrated the great value of the rhino-pharyngoscope in the diagnosis of obscure nasal lesions. Without this instrument the origin of this polypus could only have been suspected and its removal would have been probably followed by recurrence.

Spondylitis Deformans.

DR. MALCOLM SCOTT showed a man, aged twenty-six years, who was suffering from typical *spondylitis deformans*. He had once worked as a blacksmith, but six years before admission his back had become painful and had gradually stiffened until he could not do any manual work. The whole thoracic spine was kyphotic and rigid; there was no angular curvature nor were there any tender vertebræ. The other joints in the body were normal. The skiagrams showed a few pointed osteophytes at the anterior margin of the lumbar vertebræ. There was also a noticeable thickening of the inter-vertebral discs. The commoner type of osteo-arthritis of the spine was present in which the affection was limited to the vertebral joints. There were two points of interest to notice in the patient's history. In the first place he had been thrown from a sulky ten years previously and had injured his back. but he had returned to work again a week or two later. More important was the fact that seven years before he had suffered from a urethritis. The occurrence of the urethritis made the prognosis less favourable. Dr. Scott said that with rest he could be promised relief from pain and also some degree of improvement in mobility of the spine.

DR. H. GILBERT referred to a patient who had recently come under his care with complete fixation of the lumbar and lower dorsal vertebræ. A skiagram had shown osseous ankylosis of the bodies of the vertebræ. The condition had come on gradually during the preceding twelve months. The previous history included typhoid fever and dysentery in 1915 and gonorrhœa in 1917. Dr. Gilbert asked for advice as to treatment, as the condition was apparently not spreading and the man appeared to have formed his own splint. He was suffering no pain except on attempts at bending. On the assumption that the condition might be a localized form of rheumatoid arthritis iodine had been prescribed, since this drug had proved of most value in the treatment of rheumatoid arthritis in general.

DR. JOHN COBRIN remarked on the typical shrugged shoulders that were usually seen in this type of arthritis of the spine. Dr. Corbin said that he had lately had two patients in a similar condition to the one shown by Dr. Scott and in each there had been a history of gonorrhœa. He had found that protein shock, namely the intravenous injection of *Bacillus coli communis*, had relieved the pain much better than any other form of treatment.

DR. F. S. HONE said that he had found protein shock to have very beneficial effects on these patients. He said that he himself did not profess to understand how the protein shock worked, but thought that it was most probably due to the generation of heat.

DR. THOROLD GRANT remarked that A. E. Gow had contributed an article to *The Quarterly Journal of Medicine* in 1920 on the subject of the white blood cell count following intravenous protein therapy. Gow had found that the injection was followed by a transient leucopenia.

DR. CAREW NOTT stated in reply to Dr. Hone's remarks that the beneficial action of protein shock therapy appeared to be due to the hyperpyrexia induced and suggested that this point could be investigated and perhaps similar results obtained by means of diathermy. It was possible by means of a powerful diathermy apparatus to raise the temperature of the whole body several degrees and maintain it thus for a considerable length of time. The beneficial effect of diathermy in many forms of arthritis and neuritis was well known and possibly improved results could be obtained by more intensive diathermy under the lines suggested in cases similar to the one shown by Dr. Scott.

Fracture of the Scapula.

DR. H. CAREW NOTT showed a skiagram of a fracture of the scapula following a fall on the shoulder from a motor-cycle. The line of fracture extended through the centre of the glenoid fossa and down the upper half of the axillary border, the fragment being displaced downwards two and a half centimetres. The humerus was displaced downwards with the fragment causing flattening of the shoulder.

Dr. Nott also showed a skiagram of multiple renal calculi on the right side in a youth, eighteen years of age, who had recently had the first attack of right lumbar pain and hæmaturia.

Fracture of the Spine.

Skiagrams were also shown of a man who had sustained a fractured spine while driving a cart under a bridge. He had bent forward to avoid the bridge, but it had caught him in the lumbar region causing a slight compression fracture of the third lumbar vertebra and complete subluxation of the third neural arch downwards; no symptoms of spinal compression had as yet supervened.

Fracture of Transverse Processes.

DR. C. T. TURNER exhibited the skiagram of a man who had fallen out of a cart and had immediately complained of severe pain in the lumbar region. With the exception of tenderness over the lumbar vertebræ no clinical signs had been detected. The skiagram revealed a fracture of two of the tips of the transverse processes in the lumbar region, one on either side. Dr. Turner suggested that the fractures had been due to powerful muscular action and further that it was very probable that the same injury was present in many persons after similar accidents, although in the absence of a skiagram the condition was not recognized.

NOMINATIONS AND ELECTIONS.

THE undermentioned have been nominated for election as members of the New South Wales Branch of the British Medical Association:

ASHBY, HARRY LAWTON, M.B., Ch.M., 1923 (Univ. Sydney), Barellan.

EWAN, GREY LAMONT, M.B., Ch.M., 1922 (Univ. Sydney), Homebush Road, Strathfield.

TAYLOR, HENRY JOHN, M.B., Ch.M., 1923 (Univ. Sydney), Townsville Hospital, Townsville.

Correspondence.

CONCERNING THE AUSTRALIAN ARMY MEDICAL CORPS.

SIR: There can be no doubt that the present condition of the Corps is deplorable. It may be urged that it is not more so than it was in 1914 and also that there are thousands of veterans of the Corps in existence today where there were tens in 1914. That is so; but it in no way constitutes an excuse for dropping all work.

To all thoughtful men who did their share in the Great War, it is obvious that in our Corps if only a small annual sum is to be expended, every penny of it should be laid out in training officers; and in justice to our country brethren it should be laid out in such a way that they can get their fair share of it. As things are the privilege of being trained is to all intents and purposes restricted to doctors who practise in the big centres. This should not be so.

It would be wise to have a voluntary conscription of the profession so that everyone of us should be trained to take his place in the next war.

If this were arranged, then if war broke out, the Assistant Director of Medical Services of each State would know how many doctors he would need and would call on them as he required them, having due regard alike to the needs of the war and also of the home services. It could be arranged that the junior men should be called out first and as the necessary wastage occurred, that the senior men should follow them. In this way much economical waste would be prevented. Such money as our muddle-pated legislators allot in peace time for training should be utilized to insure the training of the younger men and of those who for various reasons did not serve in the Great War. No one should be allowed to remain untrained and unaccustomed to handling troops in the modest fashion in which doctors are called upon to do in war time. The training schools for officers which used to be held in the various State capitals, were admirable and if as a result of a voluntary conscription the Assistant Director of Medical Services of each State were able to make sure that every officer was qualified after an annual training at a convenient centre to do his share, then and not till then could those of us who are interested in this matter, feel sure that all is well.

There is another aspect of this question which concerns all of us who love our native land. If we decide upon a voluntary conscription, we shall set a noble example to our fellow countrymen.

To some of us it is a painful thought that Australia turned conscription down.

Let us show our fellow countrymen that we are willing to lead the way in the noblest form of altruism.

We doctors always think, though as a rule we are too shy to say so, that our lives are altruistic to a wonderful and admirable degree. It is so, and no one doubts it.

Yours, etc.,

A. Y. FULLERTON.

318, Miller Street, North Sydney,
January 12, 1924.

FULMINATING PYELITIS.

SIR: In Dr. Gill's interesting and instructive article on pyelitis there is one statement which calls for comment. Referring to fulminating cases he says: "If no relief be obtained (by medical treatment) in twenty-four to forty-eight hours, an immediate nephrectomy or nephrotomy is the only hope of saving life." I have recently reported a case (and I know of others) which would come under the category of fulminating pyelitis and which was cured by drainage of the renal pelvis by the ureteral catheter, the catheter being allowed to remain in position for twenty-four to forty-eight hours and no attempt being made to wash out the renal pelvis. As Dr. Gill points out, there is often in these cases complete occlusion of the ureter and it appears that the pain and intense toxæmia are largely due to the fact that there is no outlet for the infection resulting in increased absorption. But if such outlet be provided by the gentle passage of a catheter into the renal pelvis, absorption quickly ceases and the patient recovers.

It is probable that in these cases more drainage takes place along the outside of the catheter than through its lumen, but be this as it may, the fact remains that ureteral catheterization is well worthy of trial in fulminating pyelitis. The benefit of this procedure should be evident in two or three hours, so that very little time need be lost before proceeding to the much more serious and mutilating operation of nephrectomy.

Yours, etc.,

GLEN H. BURNELL.

85, Hutt Street, Adelaide,
January 16, 1924.

Obituary.

WILLIAM SMITHSON HOLMES.

IT is with regret that we have to announce the death of Dr. William Smithson Holmes which occurred at Newcastle, New South Wales, on December 29, 1923.

William Smithson Holmes was born at Manchester, England, forty-five years ago. Deciding on medicine as his future profession he became a student at Owens College, Manchester. He showed a natural aptitude for his work and before graduation as bachelor of medicine and bachelor of surgery at the Victoria University he gained several prizes. As a senior student he worked under the late Professor S. Delépine, of Manchester, and devoted much time to pathological research. Subsequently he was appointed as junior and later as senior house surgeon at the Oldham Royal Infirmary. After leaving Oldham William Smithson Holmes went into practice at Blackpool and remained there some years. His health, however, was not good and on this account he came to Australia about thirteen years ago. He entered into partnership with the late Harold Knowles Bean, of Wallsend and Teralba, and on the death of the latter at the war he took over the whole practice. Since then and until the time of his death he carried on a large and ever-increasing practice which embraced the towns of Teralba, Boolaroo, Toronto and many of the smaller Lake Macquarie villages. He had an unusually sound knowledge of his work and this was

confidence and won the affection of those who consulted him. He was one of the most popular, respected and highly esteemed medical practitioners in the Newcastle district.

William Smithson Holmes was devoted to his home and garden and these, situated as they were on the shores of Lake Macquarie, were among the show places of the district. His greatest interest was in his library and he was a keen student of the latest works dealing with the newer developments of medicine. The general regret at his death was manifested by the large number of residents who attended his funeral; six of his brother practitioners acted as pall bearers. The sympathy of a wide circle of friends is extended to his widow.

GEORGE ERIC MACKAY.

A CAREER full of promise was brought to an untimely termination by the death of Dr. George Eric Mackay, which occurred at St. Bartholomew's Hospital, London, on October 25, 1923.

George Eric Mackay was born at Bendigo on June 18, 1897. He was the son of Mr. and Mrs. George Mackay, of that city. By his death they have lost a second brilliant son. The elder son, Murdoch Nish Mackay, was killed at Pozières in 1916.

George Eric Mackay received his early education at the State School, Bendigo, and at St. Andrew's College and Corporate High School. During 1912 and 1913 he attended Scotch College, Melbourne, whence he proceeded in 1914 as a resident medical student to Ormond College, University of Melbourne. His scholastic career was marked by brilliant achievement throughout; he was always prominent in the honours list and secured a number of scholarships.

In his all too short career Eric Mackay won for himself a high place in the esteem and affections of his contemporaries as a scholar, a soldier and a sportsman in the highest sense of the term.

In the second years of his medical course he enlisted and in the first instance served for a period of eight months at the Australian General Hospital, Heliopolis, Egypt. He was then transferred to the 22nd battalion and in the course of service in France was at Fleurbaix and Pozières. In 1917 he returned to Melbourne and resumed his medical course which he completed with distinction in 1921. Immediately after graduation he was appointed a resident medical officer at the Melbourne Hospital.

In 1922 he was married to Miss Grace Mary Waddell, of Bendigo, and in the same year proceeded to England in order to prosecute post-graduate study. Before the end of the year he had passed the primary examination for the Fellowship of the Royal College of Surgeons, England.

From the Middlesex Hospital he went to the Rotunda Hospital, Dublin, and while studying there became ill.

As a college boy and University student Eric Mackay was known as a fine exponent of cricket and represented Scotch College, Ormond College and the Melbourne University in this field. It was in tennis, however, that he was particularly brilliant. He became captain of the Melbourne University tennis team and was chosen to represent Victoria in interstate fixtures. In England he played with success in the Folkestone tournament in 1922 and in 1923 won the tennis championship of Ireland, a hard fought contest in which he defeated a number of prominent players.

No expression of regret seems adequate in regard to the tragedy of the death of such a brilliant young man as Eric Mackay.

Dr. C. H. C. Searby writes:

It was with pride that I acceded to the request that I should write an intimate appreciation of my late friend, Dr. G. E. Mackay, yet, now with the pen in my hand I find it difficult to set out adequately what I would write. We started school at Bendigo together on the same day; we finished together a year's residentship at the Melbourne Hospital. It is doubtful to my mind whether it is the good fortune of many of us to have for those twenty-odd years, from boyhood to manhood, the friendship of one such as he was, a friendship in school and out of school, on active service, at the University and at the hospital. The idea of playing any game for the game's sake characterized all his doings. Mackay endeared himself to so many people in his numerous activities that his intimate friends must be many, from tennis court and cricket field, from University and hospital, but memories of that close companionship with him in rooms at college during our course are for but few of us.

His sane and cheerful outlook on life, life as seen through student eyes, was an inspiration to others besides myself. Each new subject, any new work in the course he regarded enthusiastically as a fresh sphere in which to glean something more to help him in his life's work. Nothing was too trivial to worry about, nothing too big to tackle. Added to this was a quiet but dogged determination that he possessed in all things; never shown better than when he was on a tennis court. And yet in no undertaking, be it work or play, could one wish for a more worthy opponent. There are many Trinity men who will ever remember how one year when Mackay was captain of the Ormond tennis team, he had the match postponed, despite intercollegiate rules, until Trinity's best man, then ill, was fit to play. It meant that what was almost a certain win became a defeat. But Mackay by his act had achieved for his college and unthinkingly for himself what years of victories could not.

Had he lived, Eric Mackay must have taken with him into his professional career that same spirit of highness of purpose and cheerfulness of faith in his fellow men and the profession is so much the poorer for his death. To those of us who worked with him, are left the very happy memories of a true friend and gentleman, together with the inspiration that his life was to do unto fellow men as he would have done and would have had us also do.

JAMES ROBERT PURDY.

IT is with regret that we have to announce the death of Dr. James Robert Purdy, of the Lower Hutt, Wellington, New Zealand, which occurred on January 15, 1924.

James Robert Purdy occupied a distinguished and honourable position in the medical profession of New Zealand. He was an ex-president of the New Zealand Branch of the British Medical Association and for services rendered during the late war he was created a Commander of the Most Excellent Order of the British Empire.

James Robert Purdy was the brother of Dr. J. S. Purdy, Metropolitan Medical Officer of Health, Sydney.

MEDICAL DEFENCE ASSOCIATION OF SOUTH AUSTRALIA.

THE annual meeting of the Medical Defence Association of South Australia was held at the Lister Hall, B.M.A. Building, Hindmarsh Square, Adelaide, on December 6, 1923, DR. H. SWIFT, the PRESIDENT, in the chair.

Election of Office Bearers.

The following were appointed to the several offices of the Association:

President: Dr. H. Swift.
Honorary Auditor: Dr. H. H. Wigg.
Honorary Treasurer: Dr. W. J. Gregerson.
Honorary Secretary: Dr. Guy Lendon .
Members of Council: Dr. J. W. Browne, Dr. M. Erichsen.

MAR 10 1924

Report of the Council.

The following report of the Council was read and adopted.

Your Council has to report a satisfactory increase in membership (nineteen) during the year and an improvement beyond the average in the financial statement.

There has been little call on the Association for help; one member reported a threat of legal proceedings. The member was referred to our solicitor's firm for advice and the case has apparently lapsed.

The Council places on record its appreciation of the work done for many years by Dr. J. Walter Browne as Honorary Secretary and is glad to have his nomination as ordinary member of Council for the coming two years

The Council considers that the rules require certain verbal alterations, with a re-arrangement of their sequence and, therefore, an alteration in their numbering. This will be submitted to the Annual Meeting for confirmation and members will be asked to alter the Rule governing Arrears of Subscription to read:

> Should any Member, except as provided by Rule 6, neglect to forward his Annual Subscription to the Treasurer before the 1st day of February, he shall have no claim to the benefits of the Association. If, after notice from the Treasurer, his subscription remains unpaid by the 31st March, he shall cease to be a member. Provided always that the Council shall have power, under special circumstances, to reinstate a member and to suspend the subscription of a member who may be absent from the State.
>
> (Signed) H. SWIFT, President.
>
> North Terrace, Adelaide,
> November 28, 1923.

Financial Statements.

From the statements presented by Dr. Gregerson, the Honorary Treasurer, it appears that the Association had a credit balance of £1,773 7s. 5d. on November 22, 1923. During the twelve months ended November 22, 1923, the amount received as subscriptions was £101. To this was added interest, the cash balances carried over from the previous year and the sum of £200 representing fixed deposit which had matured. The receipts totalled £656 13s. 5d. The total actual expenditure was £20 4s.; part of the balance of the moneys received was invested and the remainder left in the current banking accounts.

Books Received.

AN INTRODUCTION TO SURGICAL UROLOGY, by William Knox Irwin, M.D. (Aberdeen), F.R.C.S. (Edin.); 1923. London: Baillière, Tindall and Cox; Crown 8vo., pp. 188. Price: 7s. 6d. net.

CLINICAL MEMORANDA FOR GENERAL PRACTITIONERS, by Alex. Theodore Brand, M.D., C.M., V.D. and John Robert Keith, M.A., M.D., C.M.; Second Edition; 1923. London: Baillière, Tindall and Cox; Crown 8vo., pp. 389. Price: 7s. 6d. net.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF HEART DISEASE, by Francis Heatherley, M.B., B.S. (Lond.), F.R.C.S.; 1923. London: Baillière, Tindall and Cox; Demy 8vo., pp. 210. Price: 5s. net.

EMERGENCY OPERATIONS FOR GENERAL PRACTITIONERS ON LAND AND SEA, by H. C. Orrin, O.B.E., F.R.C.S. (Ed.); 1923. London: Baillière, Tindall and Cox; Demy 8vo., pp. 147, with 67 plates and figures in the text. Price: 7s. 6d. net.

THE MEDICAL YEAR BOOK, 1924, Edited by Charles R. Hewitt. London: William Heinemann (Medical Books), Limited; Crown 8vo., pp. 600. Price: 12s. 6d. net.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser," page xvi..

DEPARTMENT OF PUBLIC HEALTH, VICTORIA: District Health Officer.

MENTAL HOSPITAL, PARKSIDE, SOUTH AUSTRALIA: Junior Medical Officer.

AUSTIN HOSPITAL, HEIDELBERG, VICTORIA: Honorary Surgeon for Diseases of the Ear, Nose and Throat.

SYDNEY HOSPITAL: Honorary Physician.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429, Strand, London, W.C.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 30 - 34, Elizabeth Street, Sydney	Australian Natives' Association Ashfield and District Friendly Societies' Dispensary Balmain United Friendly Society's Dispensary Friendly Society Lodges at Casino Leichhardt and Petersham Dispensary Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney Marrickville United Friendly Societies' Dispensary North Sydney United Friendly Societies People's Prudential Benefit Society Phœnix Mutual Provident Society
VICTORIA: Honorary Secretary, Medical Society Hall, East Melbourne	All Institutes or Medical Dispensaries Australian Prudential Association Proprietary, Limited Mutual National Provident Club National Provident Association
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane	Brisbane United Friendly Society Institute Stannary Hills Hospital
SOUTH AUSTRALIA: Honorary Secretary, 12, North Terrace, Adelaide	Contract Practice Appointments at Renmark Contract Practice Appointments in South Australia
WESTERN AUSTRALIA: Honorary Secretary, Saint George's Terrace, Perth	All Contract Practice Appointments in Western Australia
NEW ZEALAND (WELLINGTON DIVISION): Honorary Secretary, Wellington	Friendly Society Lodges, Wellington, New Zealand

Diary for the Month.

JAN. 29.—New South Wales Branch, B.M.A.: Organization and Science Committee; Medical Politics Committee.
FEB. 1.—Queensland Branch, B.M.A.: Branch.
FEB. 5.—New South Wales Branch, B.M.A.: Ethics Committee.
FEB. 6.—Victorian Branch, B.M.A.: Presentation of Balance Sheets, 1923.
FEB. 8.—Queensland Branch, B.M.A.: Council.
FEB. 8.—South Australian Branch, B.M.A.: Council.
FEB. 12.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
FEB. 13.—Central Northern Medical Association, New South Wales: Clinical Meeting.
FEB. 13.—Tasmanian Branch, B.M.A.: Branch.
FEB. 14.—Brisbane Hospital for Sick Children: Clinical Meeting.
FEB. 19.—New South Wales Branch, B.M.A.: Medical Politics Committee; Organization and Science Committee.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor," THE MEDICAL JOURNAL OF AUSTRALIA, B.M.A. Building, 30-34, Elizabeth Street, Sydney. (Telephone: B. 4635.)

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